Appendix W | Socio-economic Survey of the Lake Tahoe Region

Introduction

The Lake Tahoe Basin Management Unit (LTBMU) is an integral part of the economy and social life of Lake Tahoe Basin communities. Visitors from around the country and the world are attracted to Lake Tahoe to enjoy a variety of recreational activities. The scenic quality of Lake Tahoe and its surrounding landscape make visiting the Lake Tahoe Basin a one-of-a-kind experience. The LTBMU contributes to the Lake Tahoe Basin's scenic quality through the conservation and management of vegetation, waterways, infrastructure, and recreation. Recreation opportunities supported by interpretation and conservation education enrich the recreation experience and contribute to enhancing the public's environmental literacy. The Lake Tahoe Basin's economy is driven largely by recreation and tourism. The LTBMU plays an important role in providing outdoor recreation opportunities and preserving the scenic quality of the Tahoe Basin's lands and waterways.

Information and data used in this assessment was collected from the following sources:

- U.S. Census Bureau statistics
- U.S. Bureau of Labor Statistics
- U.S. Bureau of Economic Analysis
- Economic Profile System by Headwaters Economics
- National Visitor Use Monitoring (NVUM) survey

This socio-economic assessment is provided for business planning purposes only. Prospective bidders are responsible for generating their own financial analyses and business projections using this and/or other socio-economic data. The U.S. Forest Service does not warrant and assumes no liability for the accuracy of this information.

Socio-economic Study Area

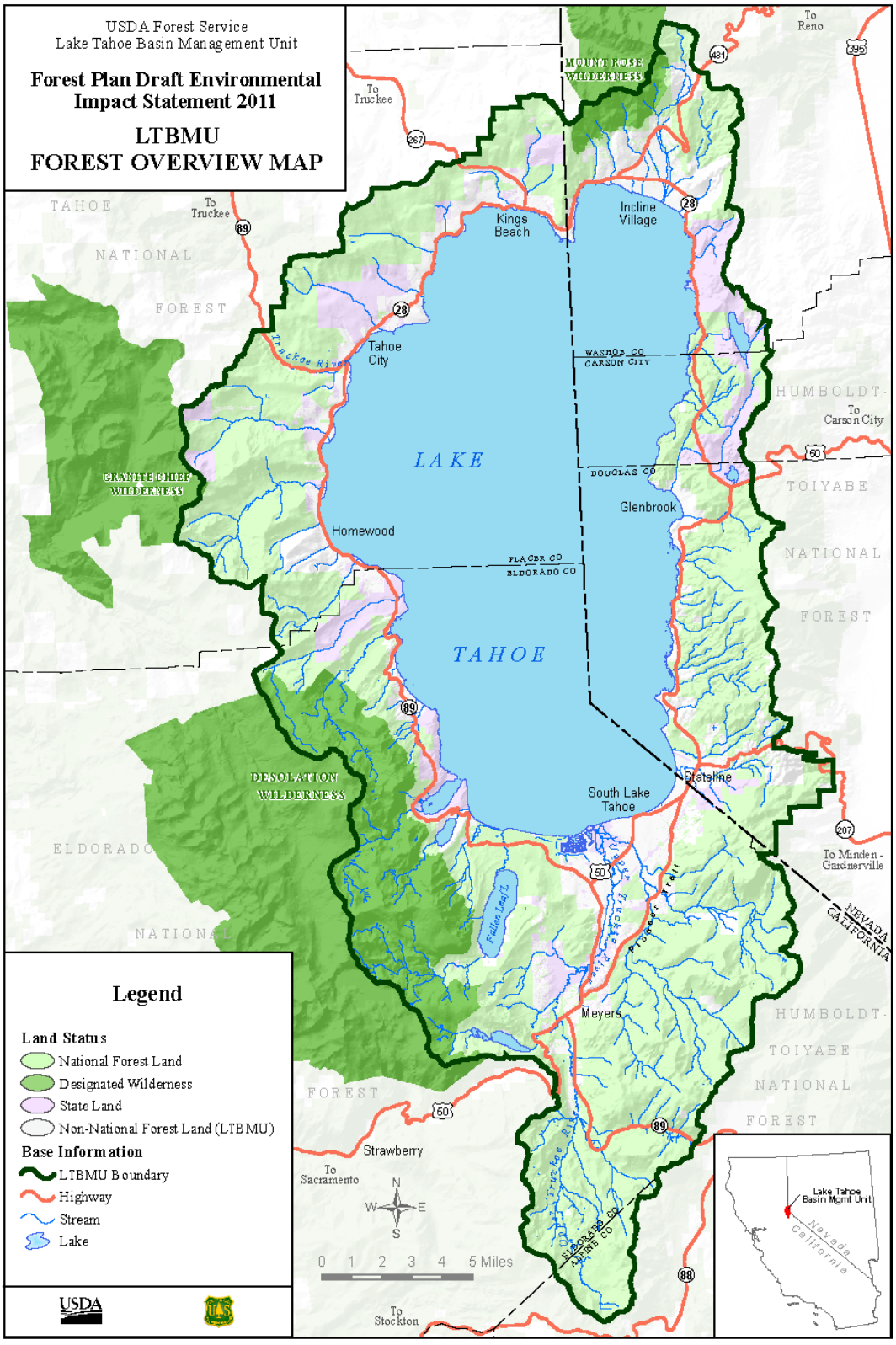
The Lake Tahoe Basin is composed of approximately 200,000 acres of land, of which the Lake Tahoe Basin Management Unit manages approximately 150,000 acres. While the land area of the Lake Tahoe Basin is relatively small, there are many political entities represented. Within the Lake Tahoe Basin, there are five counties, the Tahoe Regional Planning Agency (TRPA), two cities, and two states (see Figure 1). Along with state, county, and city ownership, close to 90% of Lake Tahoe Basin lands are in public ownership.

The communities within the Lake Tahoe Basin represent only a small share of the surrounding county's total population (which includes the large communities of Placerville, CA and Reno, NV), therefore social and economic data based on county level data overwhelms the social and economic trends of Lake Tahoe communities. While the communities in the Basin differ in many respects, they

are united by geography, economy, and social values. Two assessment areas are used in this socio-economic assessment to illustrate the roles and contributions the LTBMU plays in providing local and regional communities with social and economic benefits. The use of multiple study areas also reveals management implications associated with servicing different populations.

The larger area is represented by the Greater Lake Tahoe Area (GLTA) (see Figure 1). The GLTA is representative of the region's functional economy: this is where Lake Tahoe Region residents and businesses are likely to purchase a significant amount of their goods, services, and housing. Counties within the GLTA are influenced by spending patterns of residents, visitors, and businesses within the LTR, and have a direct influence on visitor rates and use patterns on the LTBMU. Prospective bidders should note the Basin's resident population contributes to overall visitation at National Forest System (NFS) sites and as a result, generates a sizeable portion of recreation-related revenue.

FIGURE 1: Greater Lake Tahoe Area (GLTA).

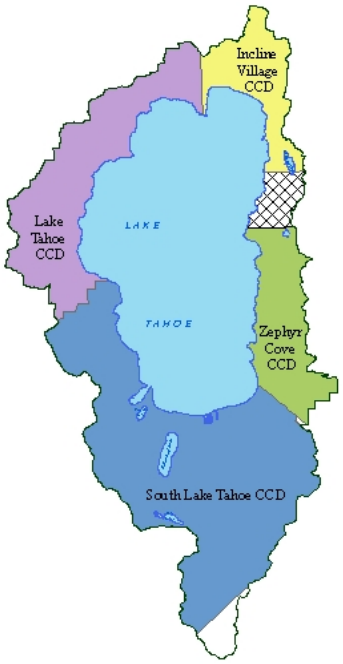


The smaller area is located within the Lake Tahoe Basin Management Unit's exterior boundary and is referred to as the "Lake Tahoe Region," or LTR (Figure 2). The communities within the LTR have a relatively high degree of economic responsiveness to recreation revenues, and there are pronounced social differences between Lake Tahoe communities and adjacent communities located outside of the Lake Tahoe Basin. Census County Divisions (CCDs) from the U.S. Census Bureau represent the geographic units used to analyze the LTR socio-economic assessment.

The Lake Tahoe Basin Management Unit's influence on the LTR economy is much greater than on the Greater Lake Tahoe economy given the relative size and diversity of the two economies.

FIGURE 2: Lake Tahoe Region by Community Civil Division (CCD).

CENSUS COUNTY DIVISIONS (CCD)	COMMUNITY
Zephyr Cove	Glenbrook Zephyr Cove Lake Ridge
Incline Village	Incline Village Stateline
South Lake Tahoe	Meyers Tahoma City of South Lake Tahoe
Lake Tahoe	Brockway Lake Forest Rampart (Sunnyside) Tahoe Pines Homewood Chambers Lodge Tahoe Vista



Historical Background

For thousands of years, the people of the Washoe Tribe traveled to the shores of Lake Tahoe in the summer to live, trade, and reaffirm tribal unity. The Washoe way of life was greatly impacted in 1859 with the Virginia City silver strike, which marked the beginning of the Comstock Era. By 1890, the forests of Lake Tahoe had been largely clear-cut to fuel mining operations, shore-up mine shafts, and provide building supplies for rapidly growing Virginia City. The lands around Lake Tahoe provided forage for sheep and were home to Basque sheepherders from the 1850s to the 1950s.

In 1899, President William McKinley designated 13,000 acres of Lake Tahoe forests as National Forest Reserves, which would mark the beginning of federal acquisitions in the Lake Tahoe Basin. Between 1890 and 1920, Lake Tahoe was a popular resort destination for wealthy and elite families from San Francisco. Roads were paved during the 1920s and 1930s and as a result Lake Tahoe became more accessible to a greater number of people, and tourism and recreation soon became a

dominant industry in the Basin. The 1940s marked the beginning of the gaming industry, which grew quickly, attracting vacationers looking for urban amenities in a scenic setting. With the 1960 Winter Olympic Games hosted at Squaw Valley Resort, development escalated as Tahoe became known as an international recreation destination.

At this same time, the Forest Service acquired large tracts of land in the Lake Tahoe Basin, and management of this land was divided among three forests: the Eldorado, the Humboldt-Toiyabe and the Tahoe National Forest. However, by 1973, National Forest land managers recognized the need to manage Lake Tahoe's upland resources separately to preserve the unique nature of Lake Tahoe. It was in support of this goal that the Lake Tahoe Basin Management Unit was formed by carving out sections of the three forests to approximate Lake Tahoe's watershed boundary.

Much of the LTBMU's management priorities and objectives have been driven by legislative acts, which have served to authorize funding for the acquisition and restoration of lands within the Lake Tahoe Basin. In 1980, Congress passed the Santini-Burton Act (PL 96-586), which authorized funding and directed the LTBMU to acquire environmentally-sensitive lands, restore watersheds on National Forest System lands, and administer erosion control grants to local government. Thirteen thousand acres have since been acquired through the Santini-Burton Act, of which many are small parcels interspersed throughout urban neighborhoods.

The Lake Tahoe Restoration Act (LTRA), signed by President Bill Clinton in 1997, recognized the unique scenic and ecological features of Lake Tahoe, as well as Lake Tahoe communities' economic dependence on the preservation of these characteristics. The LTRA was designed to enable the Forest Service to plan and implement significant new environmental restoration and forest management activities to address water quality, water clarity, and forest health in coordination with Federal, State, local, regional, tribal, and private entities. While the LTRA was intended to increase restoration in the Lake Tahoe Basin, this objective was not fully implemented due to lack of federal funding until the Southern Nevada Public Lands Management Act (SNPLMA) was amended in 2003. The SNPLMA amendment guaranteed agencies in the Lake Tahoe Basin a consistent flow of federal funds for eight years, with an average annual funding level of $37.5 million. With these funds, large watershed restoration projects to restore meadows and forest health and reduce fuels have commenced. These funds are expected to be substantially spent by 2018 and exhausted by 2020.

Social Conditions and Trends

Population

The LTR, with a population of 55,665 represents a small fraction of the GLTA population of 1,053,168 people in 2010. Within the LTR, more than half of the population resided in the South Lake Tahoe CCD. Between 2000 and 2010, Nevada's population grew by 35%, while California's population grew at a much slower rate, increasing by 10%. The GLTA grew in population by over 25%. In contrast, the LTR lost 11.5% of its population. An article in the Sierra Sun (March 9, 2011) attributed this loss in population to a worsening economy. Also, the gaming industry declined over 50% since 1990 so there are fewer jobs in the LTR to hold people there. There is also a trend toward increasing second home ownership by people who do not live year-round in the Lake Tahoe Basin area. These are used as vacation homes and do not contribute toward such things as kids in schools, year-round shopping in the local community, etc.

TABLE 1: Population 2000 to 2010.

ASSESSMENT AREA	2000 CENSUS	2010 CENSUS	% CHANGE SINCE 2000
Nevada	1,998,257	2,700,551	35.1%
California	33,871,648	37,253,956	10.0%
Carson City Co, NV	52,457	55,274	5.4%
Douglas County, NV	41,259	46,997	13.9%
Washoe County, NV	339,486	421,407	24.1%
El Dorado County, CA	156,299	181,058	15.8%
Placer County, CA	248,399	348,432	40.3%
Greater Lake Tahoe Area (GLTA)	837,900	1,053,168	25.7%
Incline Village CCD, NV	9,952	9,087	-8.7%
Zephyr Cove CCD, NV	6,739	5,402	-19.8%
Lake Tahoe CCD, CA	12,158	10,448	-14.1%
South Lake Tahoe CCD, CA	34,042	30,728	-9.7%
Lake Tahoe Region (LTR)	62,891	55,665	-11.5%
% LTR of GLTA	7.5%	5.3%	-

FIGURE 3: Percent Population, LTR, 2010.

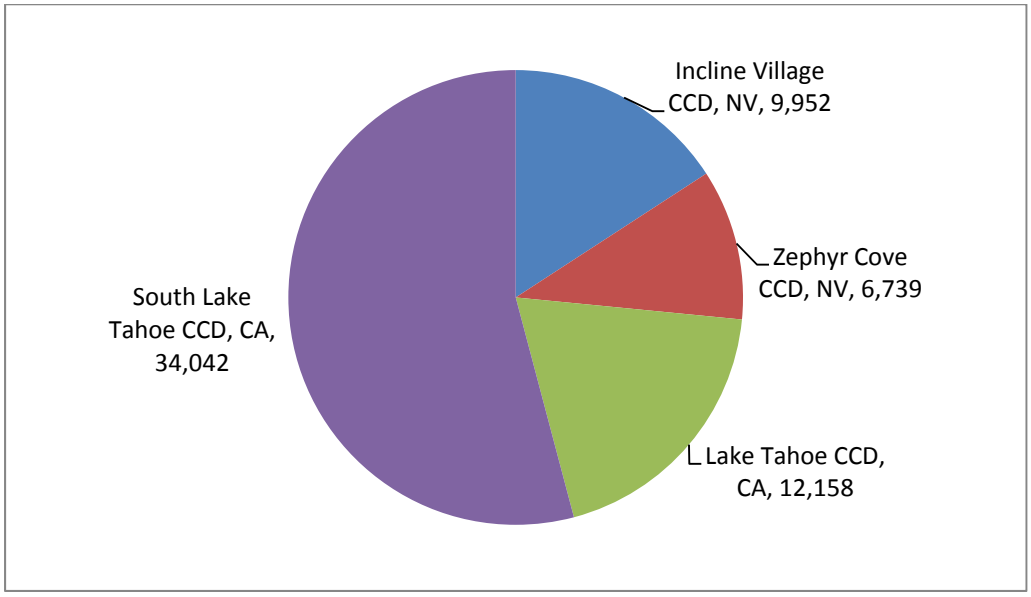


FIGURE 4: Population Change, Regional, 1990 – 2000.

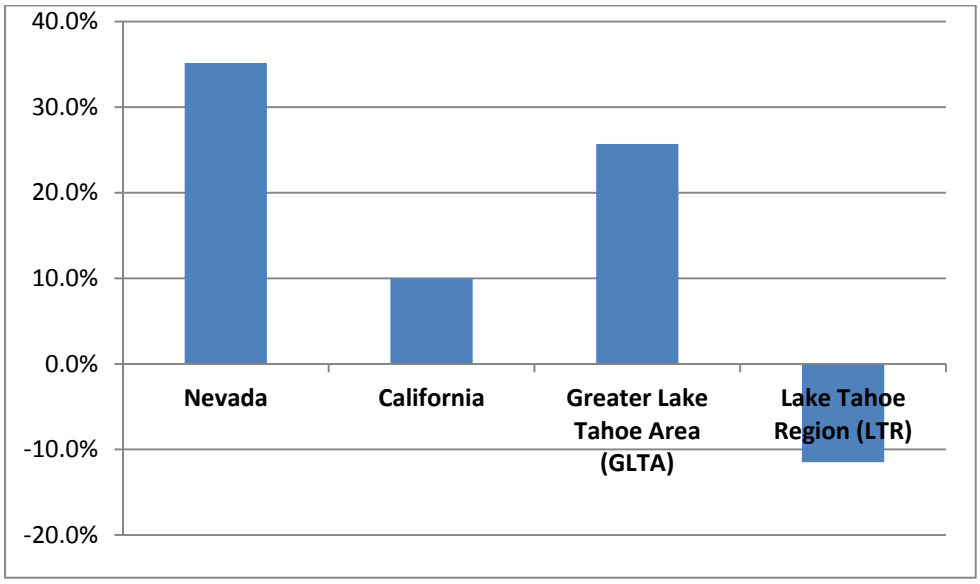
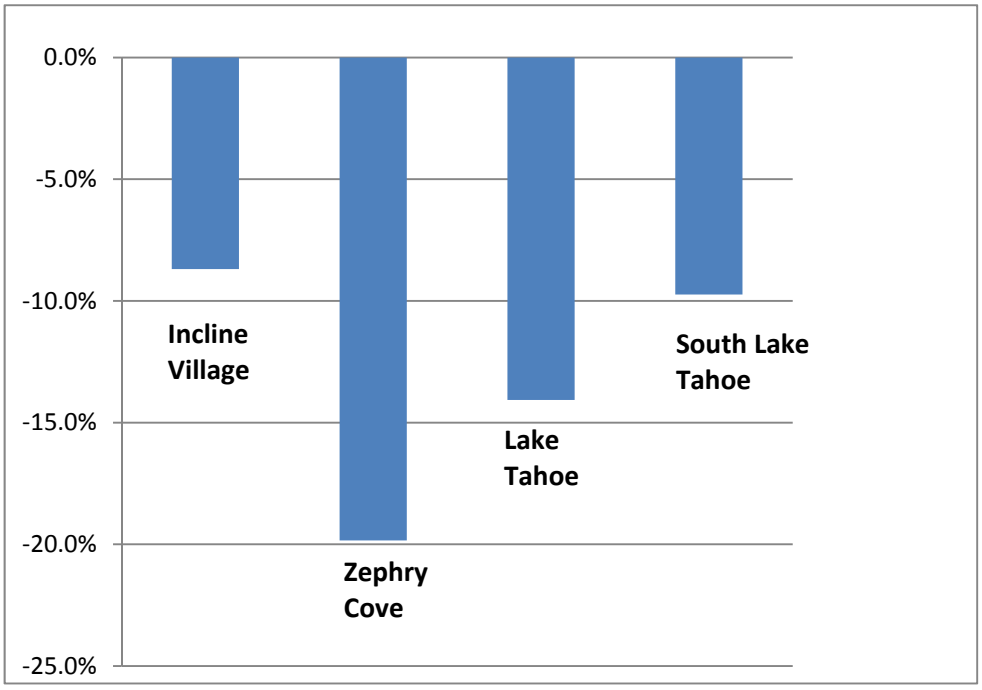


FIGURE 5: Population Change, LTR, 2000 – 2010.



Race and Ethnicity

Compared to greater California and Nevada, the GLTA and the LTR are not as racially and ethnically diverse. In the GLTA, 82% of the population is white, while in the LTR, 84% of the population is white. Within the LTR, South Lake Tahoe CCD is the most racially diverse of the four CCDs, followed by Lake Tahoe CCD.

Just over 37% of California's population was Hispanic in 2010, while Nevada's Hispanic population was reported at 26%. The GLTA had the lowest Hispanic population of the four regions, while the LTR, with a 22% Hispanic population, was similar to Nevada's Hispanic composition. Within the LTR, 12,206 people identified themselves as Hispanic during the 2010 Census. The South Lake Tahoe CCD had the largest Hispanic population with 7,345 people representing 24% of the SLT CCD population. Lake Tahoe CCD was 27% Hispanic, with 2,720 Hispanic residents. The South Lake Tahoe CCD and Lake Tahoe CCD had on average over 4 times the population of Hispanics than Incline Village and Zephyr Cove.

FIGURE 6: Race and Ethnicity, Regional, 2010.

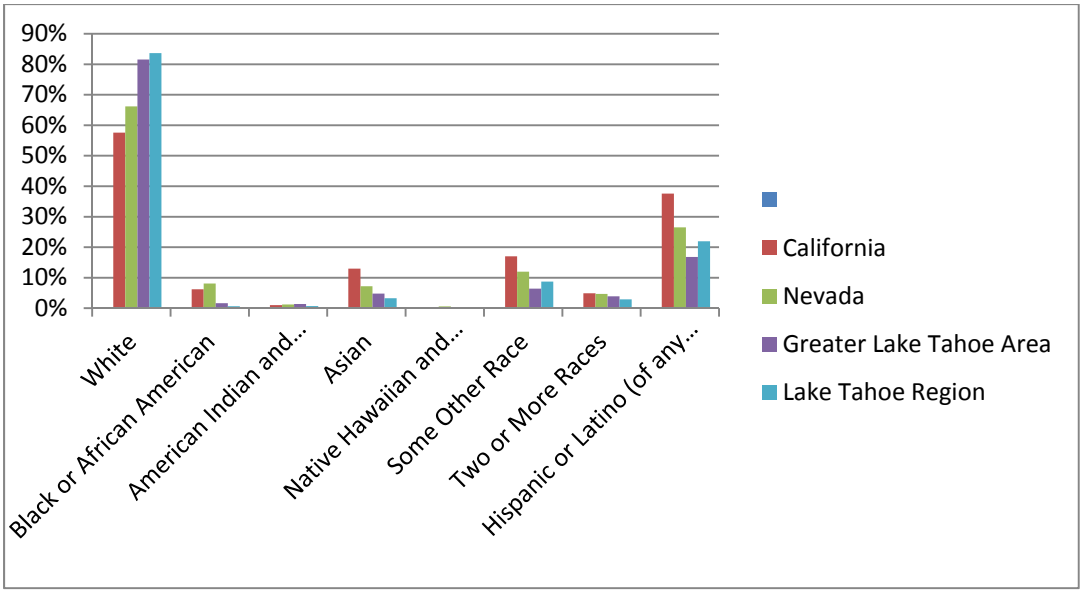


FIGURE 7: Race and Ethnicity by CCD, LTR, 2010.

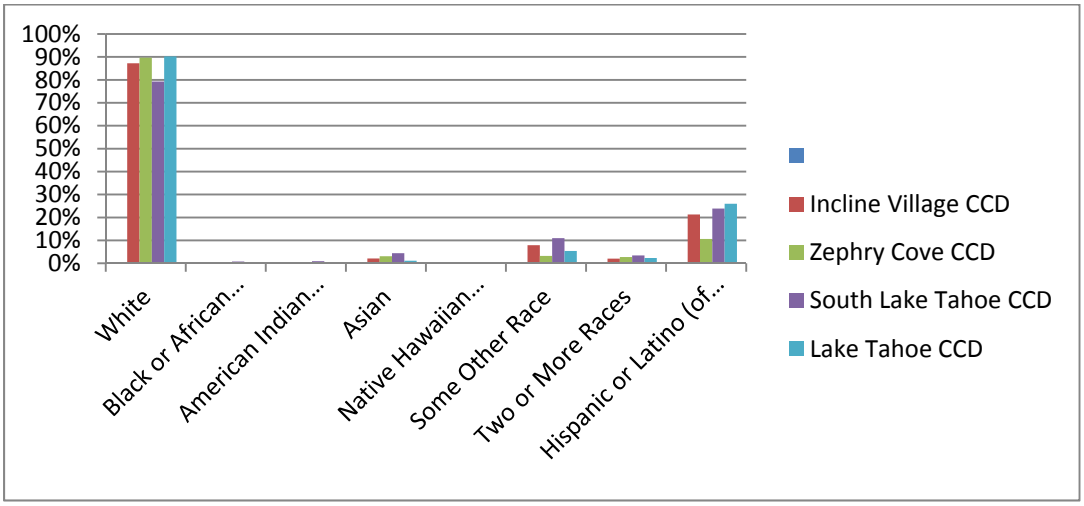


TABLE 2: Race and Ethnicity, LTR, 2010.

RACE/ETHNICITY	INCLINE VILLAGE CCD	ZEPHYR COVE CCD	SOUTH LAKE TAHOE CCD	LAKE TAHOE CCD	TOTAL LAKE TAHOE REGION
Total population	9,087	5,402	30,728	10,448	55,665
One Race	8,905	5,254	29,689	10,203	54,051
White	7,928	4,844	24,370	9,425	46,567
Black or African American	29	31	238	48	346
American Indian and Alaska Native	29	29	280	51	389
Asian	194	165	1349	112	1820
Native Hawaiian and Other Pacific Islander	7	10	58	5	80
Some Other Race	718	175	3394	562	4849
Two or More Races	182	148	1039	245	1614
HISPANIC OR LATINO					
Hispanic or Latino (of any race)	1,566	575	7,345	2,720	12,206
Not Hispanic or Latino	7,521	4,827	23,383	7,728	43,459

Poverty

(Note: Poverty statistics were not updated to the 2010 Census information as of this writing (9/8/2011), so 2000 Census data was used.) Census poverty estimates are based on a set of income thresholds for various family sizes and are the same regardless of geography or cost of living. If a family is found to make less than the threshold, then every family member is considered to be in poverty. So while it appears that across almost all races, people living in the GLTA and LTR experience less risk of living in poverty than the general population of California and Nevada, this may not accurately reflect the occurrence of poverty within the LTRs high cost-of-living census county divisions within the Lake Tahoe Basin.

FIGURE 8: Poverty by Race and Ethnicity, Regional, 2000.

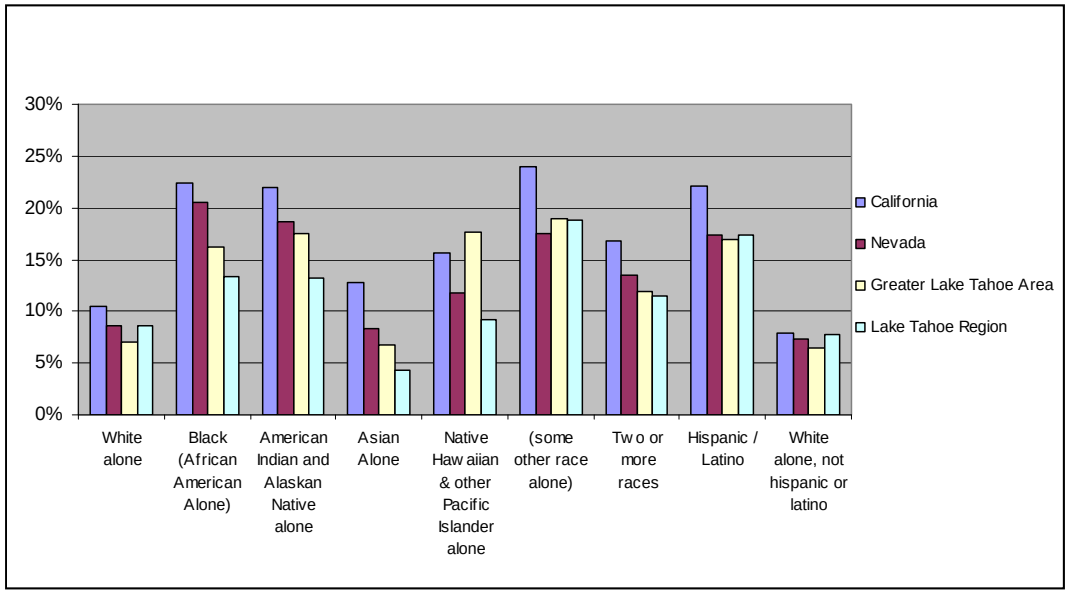
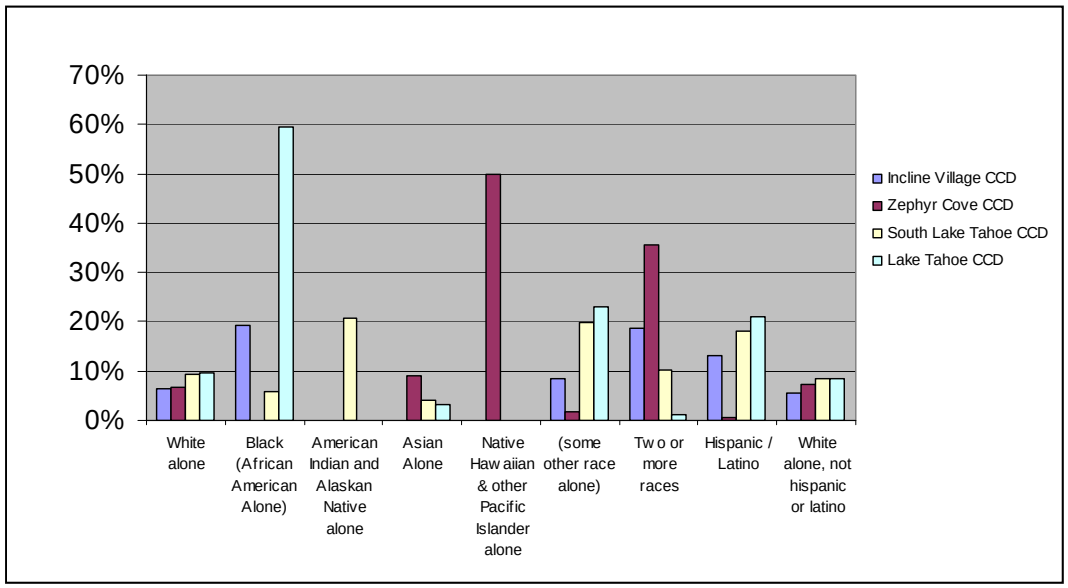


FIGURE 9: Poverty by Race and Ethnicity, LTR, 2000.



Age Distribution

The GLTA and LTR had more people in the 45 to 64 age range than Nevada and California, and less people under 45 than Nevada and California. The GLTA and LTR had fewer young people under 19 than Nevada and California. When looking at communities in the LTR, Nevada community populations were older than California community populations. Fifty-four percent of Nevada communities within the LTR were 45 years and older, compared to California communities within the LTR at 41%.

FIGURE 10: Age Distribution, Regional, 2010.

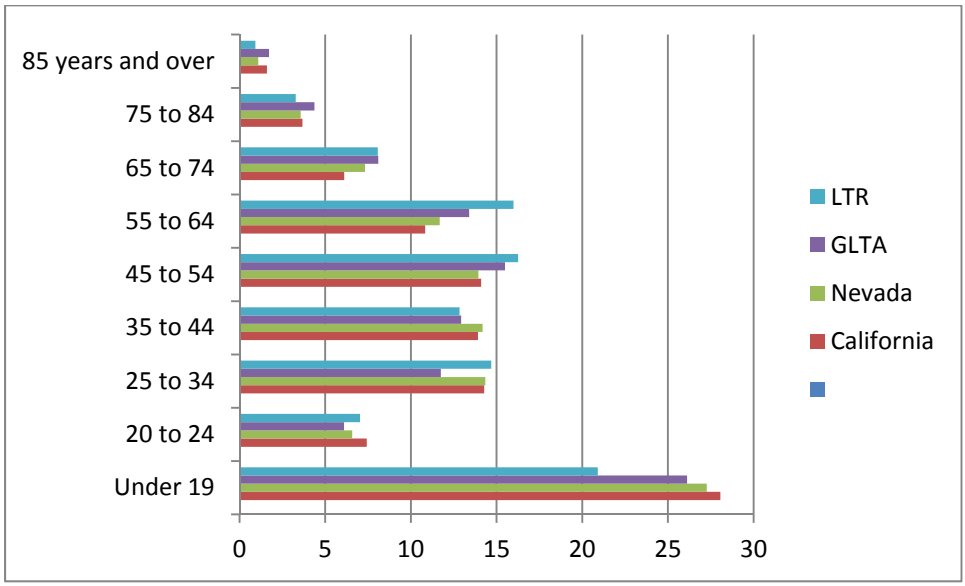
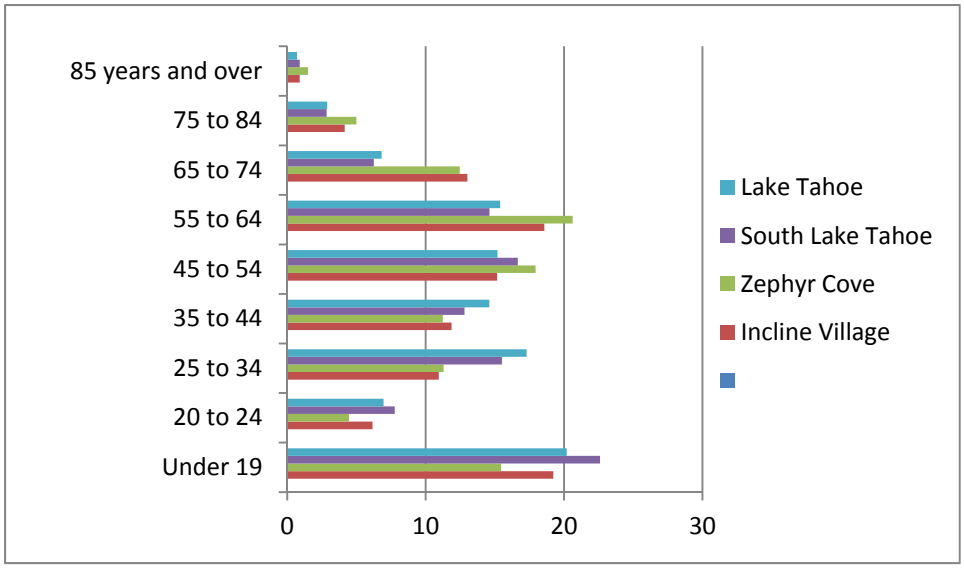


FIGURE 11: Age Distribution, LTR, 2010.



Educational Attainment

(Note: Educational Attainment was not yet available for the 2010 Census data, so to the 2000 Census data was used.) Educational Attainment in the GLTA and LTR compared favorably against state percentages. Both the GLTA and LTR had a higher percentage of high school graduates than Nevada and California. When considering the percentage of population with a bachelor's degree or higher, the LTR outranked all other regions; however, GLTA was consistent with California and exceeded Nevada's rate.

FIGURE 12: Educational Attainment, Regional, 2000.

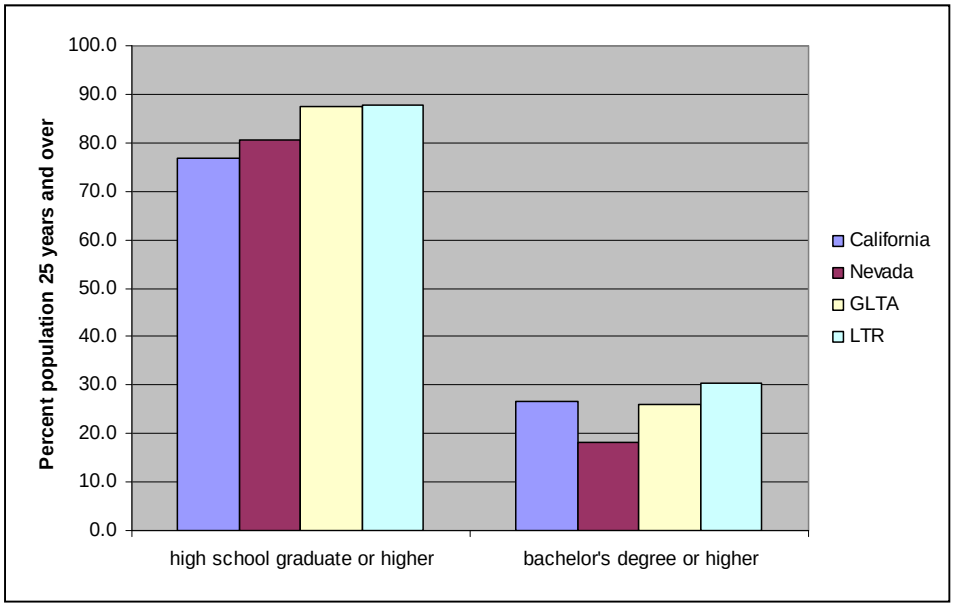
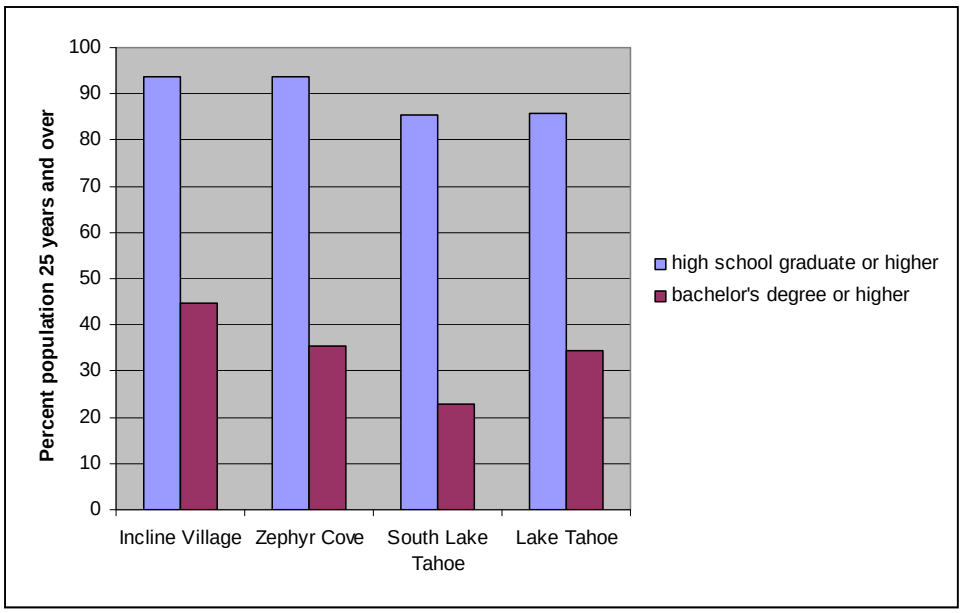


FIGURE 13: Educational Attainment, LTR, 2000.



Housing

When considering housing occupancy status, the LTR differs greatly from all other regions with a 45% vacancy rate, outstripping the next highest rate: 34% within the GLTA. Of the vacant housing units, the LTR and the GLTA were used primarily for seasonal, recreational, or occasional use. Only 8% of the vacant homes in the LTR were rental units compared to 34% for California and 37% for

Nevada. When looking at homeownerships rates, the GLTA exceeded all other regions and the LTR was on par with California and Nevada.

FIGURE 14: Housing Occupancy Status, Regional, 2010.

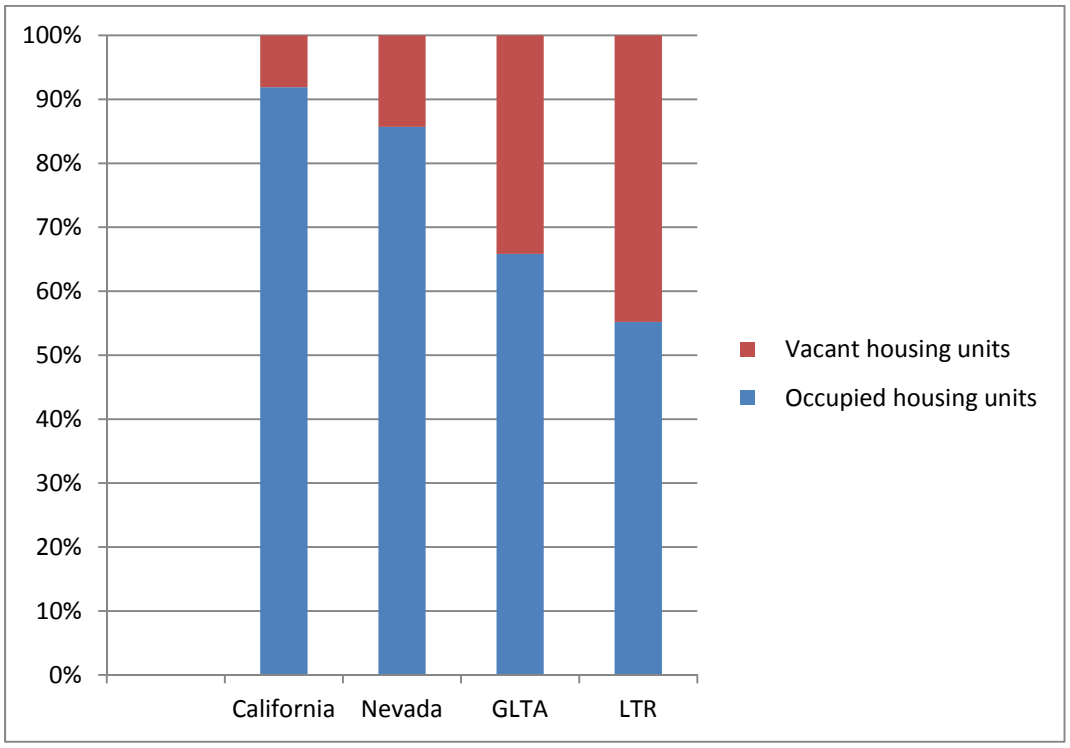


FIGURE 15: Housing Occupancy Status, LTR, 2010.

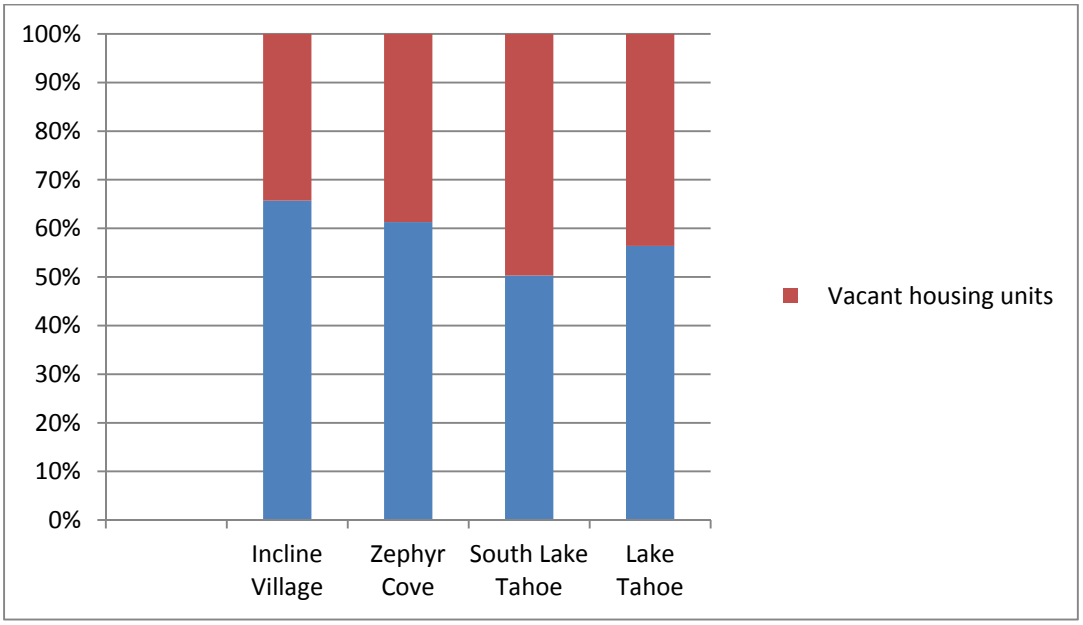


FIGURE 16: Housing Tenure, Regional, 2010.

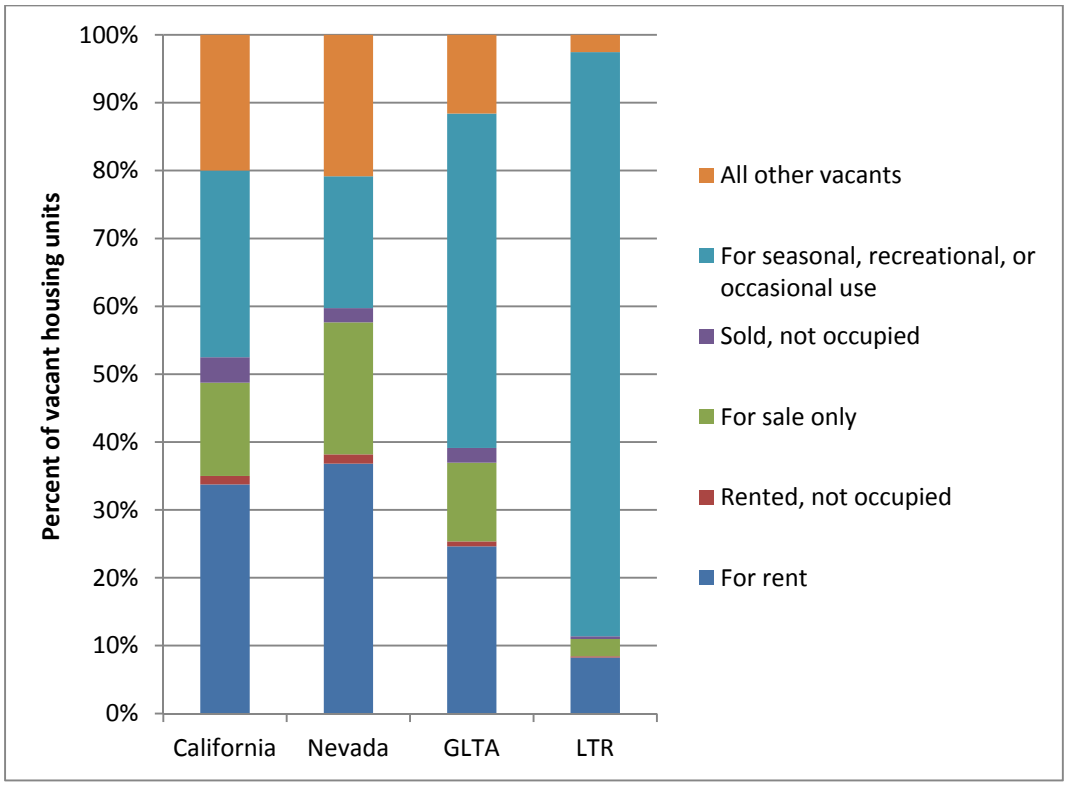
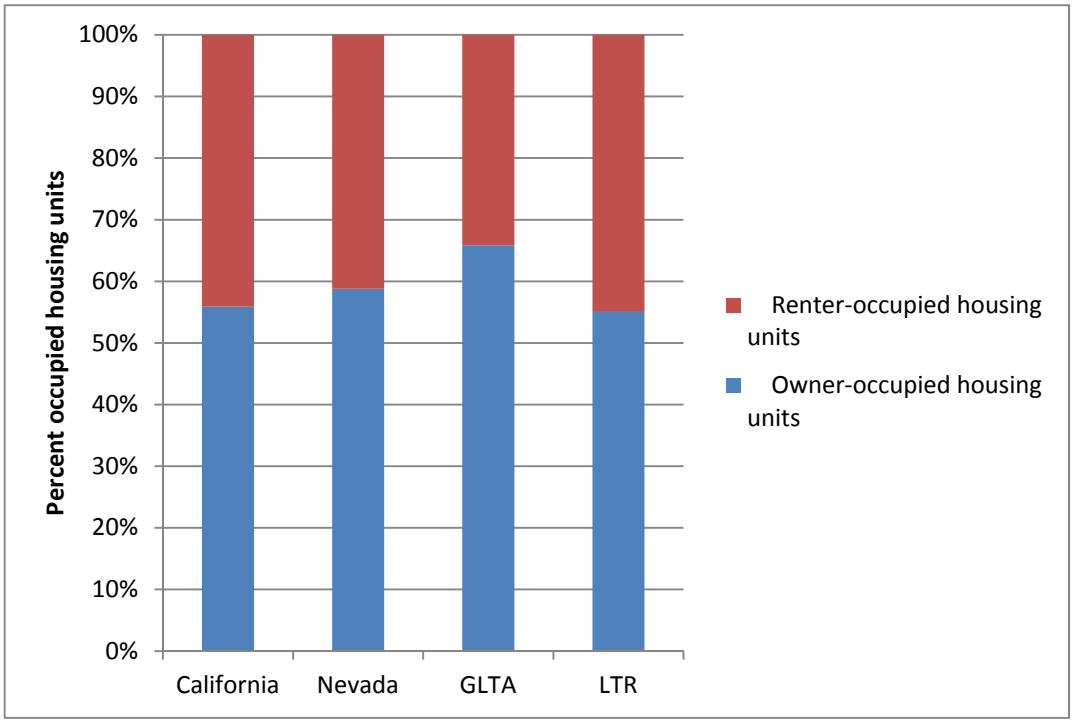


FIGURE 17: Renter vs. owner-occupied housing, 2010.



Social Conditions and Trends Discussion

The 25% rise in population between 2000 and 2010 in the GLTA translates into higher day-use demand being placed on recreation opportunities in the Lake Tahoe Basin. As reported by National Visitor Use Monitoring reports, shown in Figure 14, 41.7% of visitors live within the GLTA. Compared to the surrounding area and states of California and Nevada, it is unusual to see an 11% drop in population from 2000 to 2010 in the LTR. This is at least in part due to a decline in the gaming/casino industry, increased second home ownership, and the general decline in economic condition over this time period.

California LTR communities were generally younger and had a greater degree of ethnic diversity than Nevada communities. With respect to ethnic diversity, the LTR was just a little over half of the California Hispanic percent of population. This indicates a need to design interpretive displays, education programs and planning events that integrate the Lake Tahoe Basin's Hispanic communities in National Forest land management. Meetings designed to integrate the Hispanic community should be located in areas with the greatest concentration of Hispanic population.

Overall communities in the GLTA and LTR had relatively high educational attainment rates when compared to state rates. The GLTA and LTR high school graduation rates exceeded that of California and Nevada, as did three LTR communities: Incline Village CCD; Zephyr Cove CCD; and Lake Tahoe CCD; exceed state rates in percentage of bachelor's degree or higher.

The housing status in the LTR is vastly different in respect to occupancy status and vacancy status from the other regions compared in this study. Close to half of the housing units in the LTR are vacant for seasonal, recreational, and occasional use. This presents a challenge in respect to communicating with and involving absentee landowners in forest planning and programs.

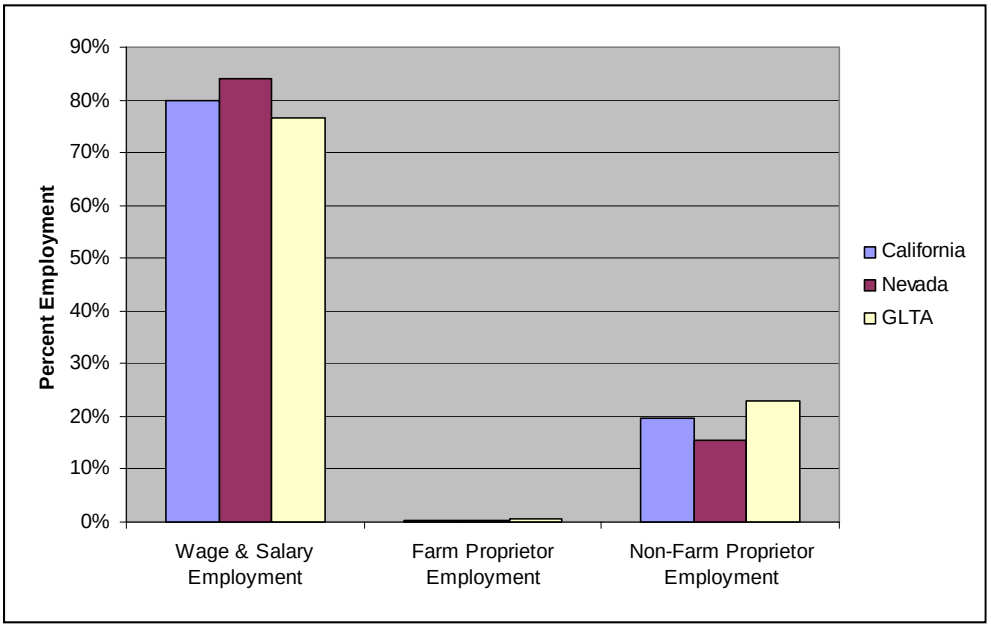
Economic Conditions and Trends

Note: Employment and Income for the Lake Tahoe CCD's had not been updated to the 2010 Census as of this writing (9/16/11), so the write-up using the earlier information from the previous Social-Economic Specialist Report written by Christy Prescott (former LTBMU Economist and Susan Winter (Economist for the WO Ecosystem Management Coordination staff) is presented here as it was written.)

Employment

The number of full-time and part-time positions in the GLTA was 623,742 in 2003. Wage and salary positions comprised the largest sector, which accounted for 77% of employment, while non-farm proprietorship accounted for 23%, and farm proprietorship accounted for 0.5 %. The GLTA non-farm proprietor sector accounts for 3.4% more in employment and 3.5% lower in wage and salary employment than California and Nevada combined. Farm proprietor employment was slightly higher in the GLTA than in Nevada and California. Nevada and El Dorado Counties' employment composition differed the most from the GLTA, with a greater proportion of employment from non-farm proprietorships and lesser proportion of employment in wage and salary employment.

FIGURE 18: Employment by Labor Sector, Regional, 2003.



When considering the GLTA's employment by industry compared to state figures, the GLTA more closely resembles California's employment structure over Nevada's. Public administration and retail sales provided the greatest share of employment in the GLTA and California. Employment in accommodations and food service was the third highest in the GLTA with 11%; however, Nevada outpaced the GLTA by 10%. Overall, the GLTA employment was more evenly distributed across industries than Nevada, but less so than California.

FIGURE 19: Regional Comparison of Employment by Industry (NAICS), 2003.

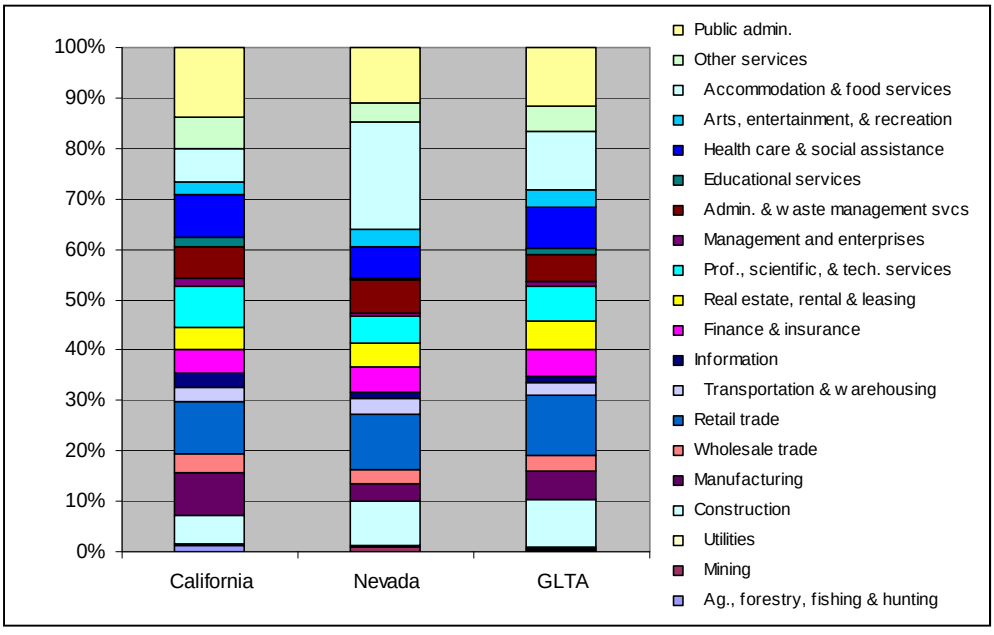


Figure 20 illustrates the employment structure of the GLTA and LTR in 2006. Employment represents part-time, full-time, seasonal, and temporary jobs in the given category. The GLTA has a

greater degree of diversity than the LTR, which is to be expected given that the GLTA encompasses a metropolitan area, as well as rural areas. Tourism-related industries dominate the LTR economy with over a quarter of employment opportunities in accommodation and food services, and 8% in arts, entertainment, and recreation. Tourism-related industries assume a much smaller percentage in the GLTA with accommodation and food services accounting for 11% and arts, entertainment and recreation accounting for 3% of employment.

FIGURE 20: Employment by Industry (NAICS), GLTA and LTR, 2006.

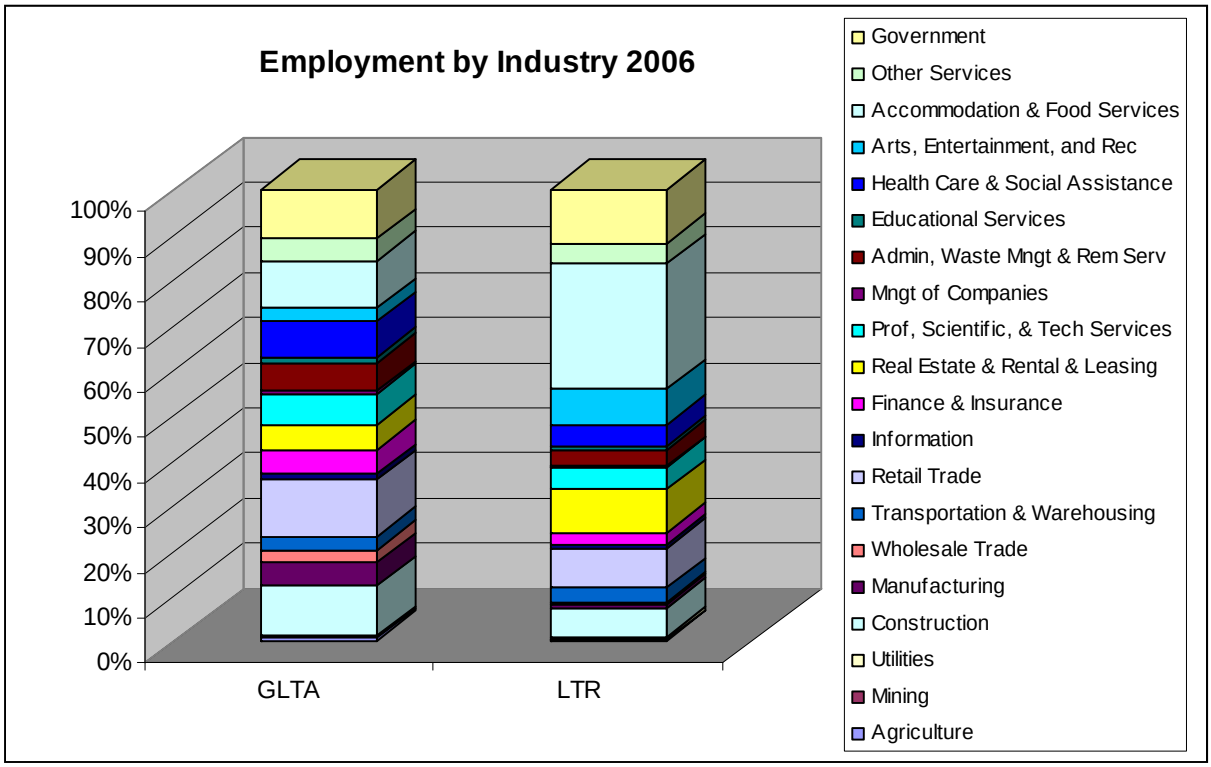


Figure 21 illustrates employment by industry among census county divisions (CCD) within the Lake Tahoe Region. The Zephyr CCD far exceeds all other CCDs in the Lake Tahoe Region in the arts, entertainment, and recreation sector; this is explained by the large gaming industry located on the south shore in Nevada. Accommodation and food services provide the greatest number of positions in Incline, El Dorado, and Placer CCDs. The most diversified economy in the LTR is Incline Village CCD, meaning that employment by industry is more evenly distributed across industries in Incline CCD than in other CCDs.

FIGURE 21: Employment Distribution by Industry (NAICS), 2000. Lake Tahoe Region by CCD.

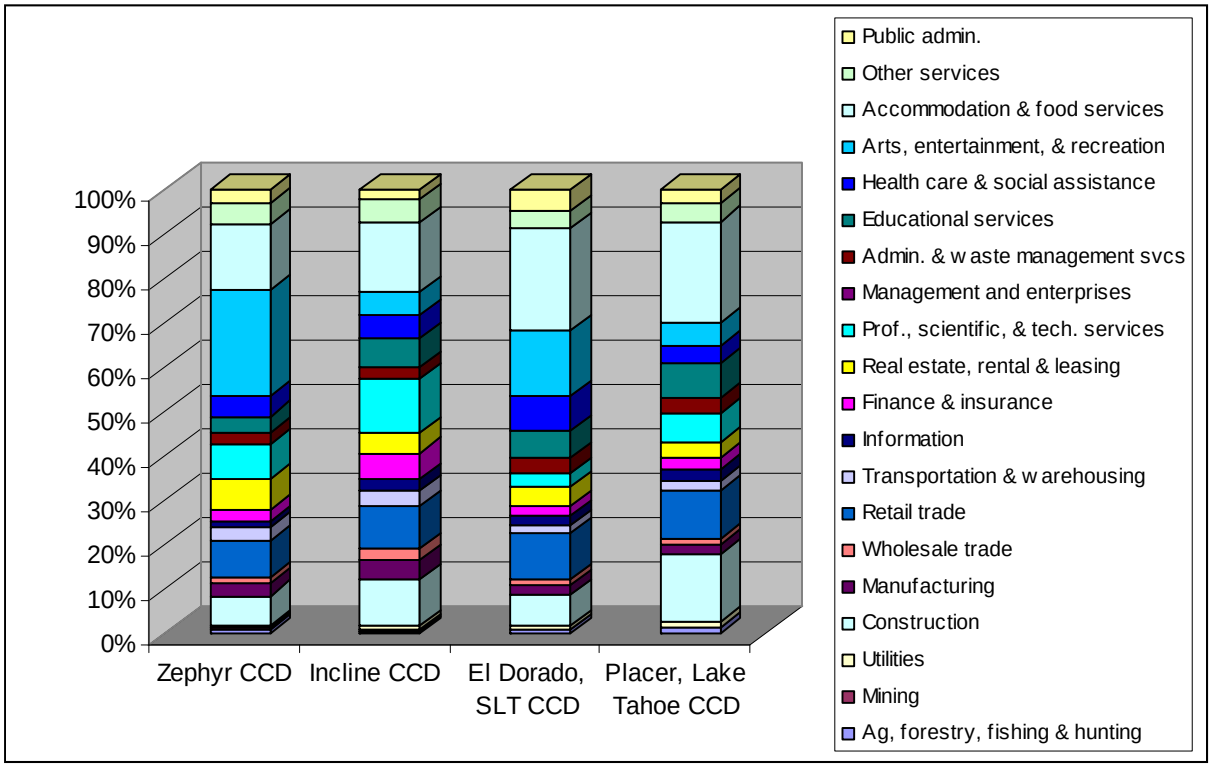
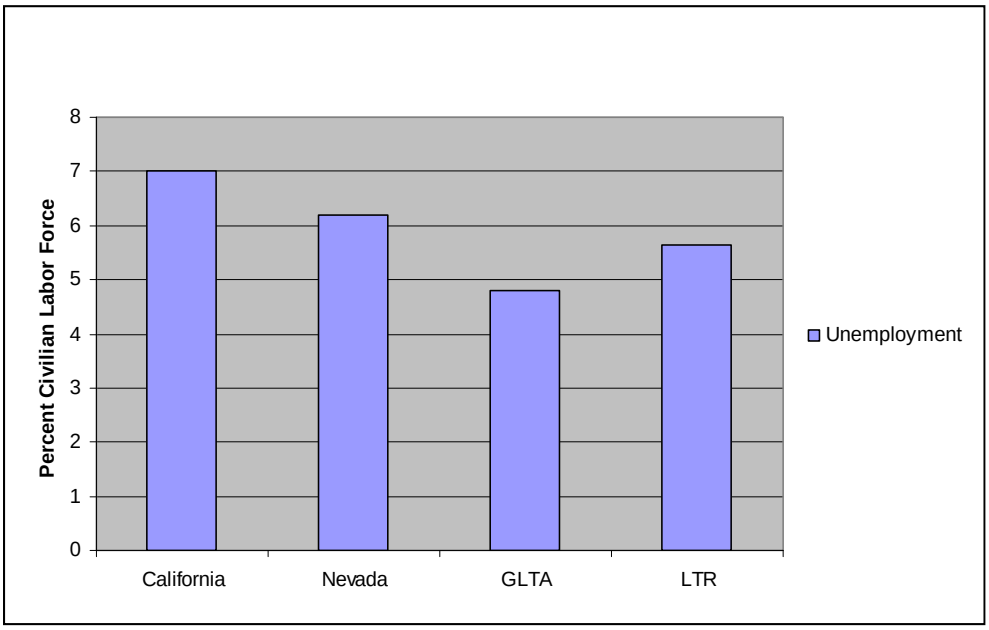


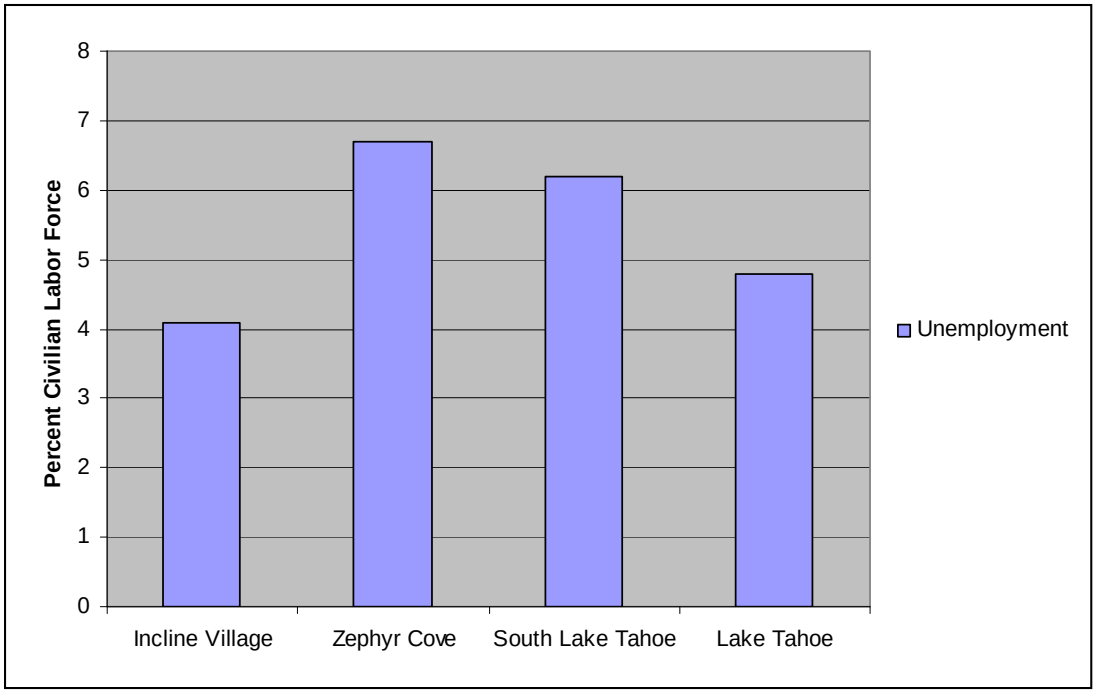
Figure 22 illustrates the unemployment rates for California, Nevada, the Greater Lake Tahoe Area, and the Lake Tahoe Region in 2000. The unemployment rate for the LTR was lower than both California and Nevada; however, it exceeded the unemployment rate for the GLTA, which had the lowest unemployment rate of the four regions.

FIGURE 22: Regional Unemployment, 2000.



When comparing the CCDs that comprise the LTR, it appears that south shore communities had higher unemployment rates than north shore communities (Figure 23). The higher unemployment rates on the south shore may be explained by the greater degree of employment being occupied by the arts, entertainment and recreation industries, which are subject to the seasonal influx of visitors. Employees in these industries often work seasonally.

FIGURE 23: Unemployment, Lake Tahoe Region CCDs, 2000.



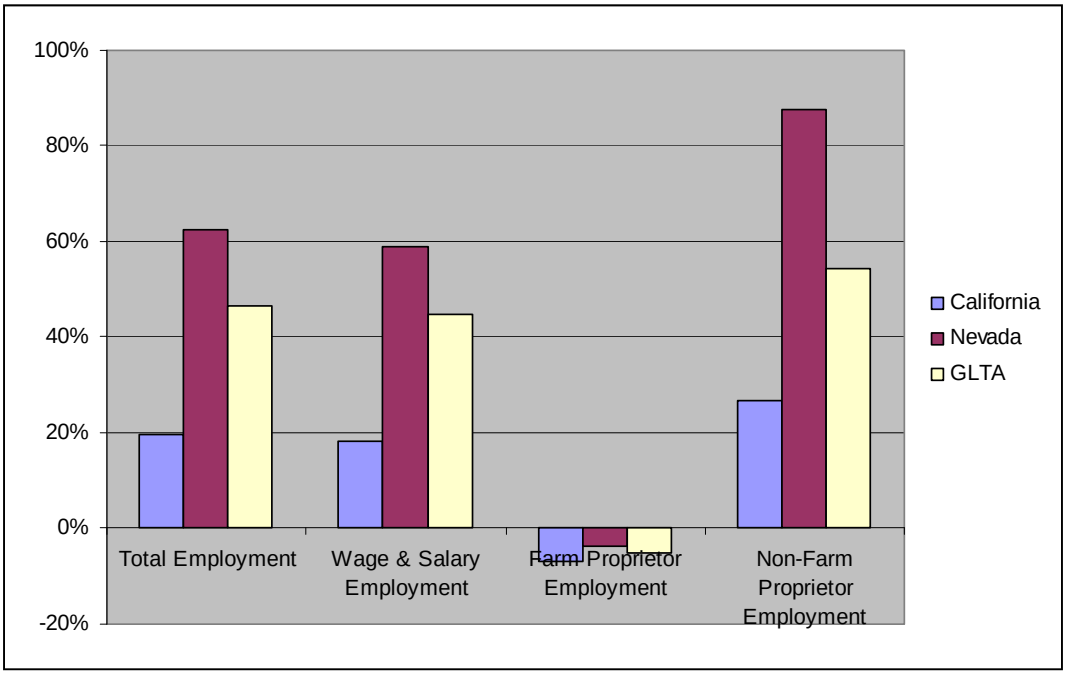
Employment Trends

Overall, employment growth in the GLTA outpaced California but lagged behind Nevada. From 1993 to 2003, total employment in the GLTA increased by 46%. Nevada outpaced the GLTA by 19%; however, the GLTA outpaced California by 26% in increased employment opportunities.

The greatest increase in positions in the GLTA was in the non-farm proprietor sector, which increased by 54%. While the GLTA lagged behind Nevada's increase in the non-farm proprietor sector by 34%, the GLTA exceeded California's increase by 27%. The GLTA, Nevada, and California all experienced declining employment in the farm proprietor sector. The greatest loss was in California, which declined by 7% and the smallest decline was in Nevada, which declined by 4%.

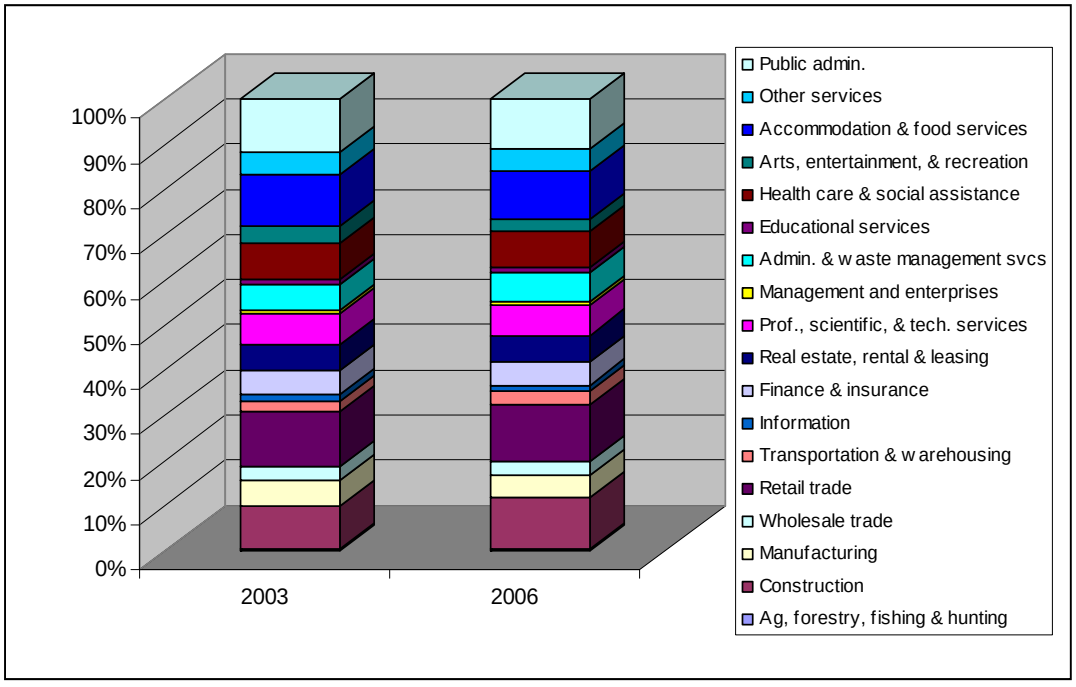
While Nevada led California in increasing employment, all the Nevada counties represented in the GLTA were below the state average. The California counties were above the state average. Placer County increased employment opportunities by 74%, with the greatest percentage of the positions in wage and salary employment. Nevada County showed the largest gain from 1993 to 2003 in the non-farm proprietor sector and had the greatest number of positions in non-farm proprietor employment.

FIGURE 24: Trends in Employment by Labor Sector, Regional, 1993-2003.



From 2003 to 2006, employment by industry in the GLTA was relatively stable (Figure 25). Construction lead in growth, increasing employment by 1.64%, and accommodation and food services, which declined in total share of employment by 0.8%, accounted for the greatest decline in the GLTA.

FIGURE 25: Trends in Employment by Industry, Greater Lake Tahoe Region, 2003-2006.



Between 2000 and 2006, the Lake Tahoe Region's employment by industry was more volatile than the GLTA (Figure 26). Public administration grew by 8%, followed closely by accommodation and food services at 7% and real estate at 6%. Industries that exhibited a decline in share of employment are the arts, entertainment, and recreation sector, which declined by 4% and the construction sector, which declined by 3%.

FIGURE 26: Trends in Employment by Industry, Lake Tahoe Region, 2000-2006.

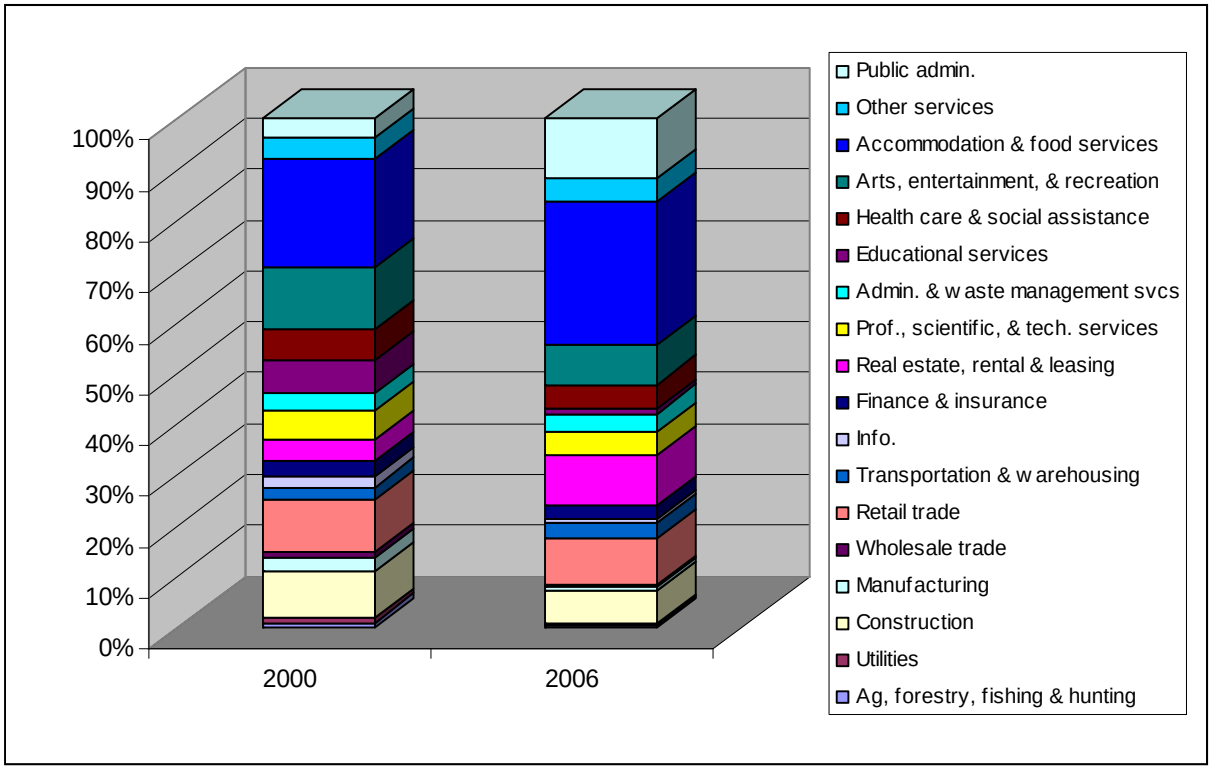


Figure 27 illustrates trends in regional unemployment rates from 1990 to 2000. In both the GLTA and the LTR, unemployment rates fell over the 10-year period, while in Nevada the unemployment rate stayed the same and in California unemployment rose during the same period.

FIGURE 27: Trends in Unemployment Rates, Regional, 1990 – 2000.

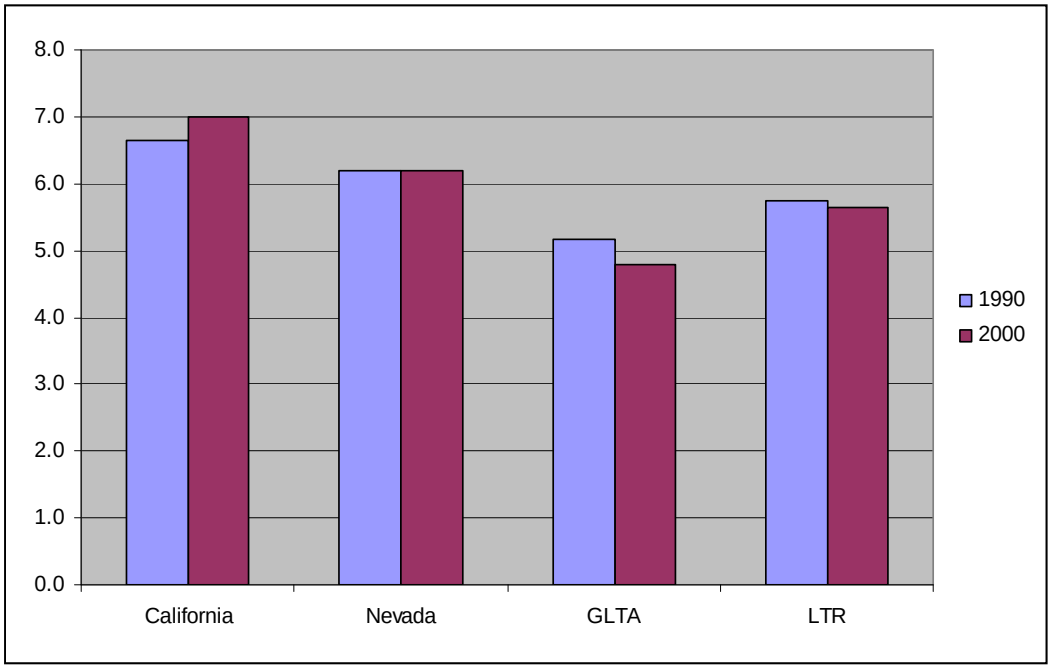
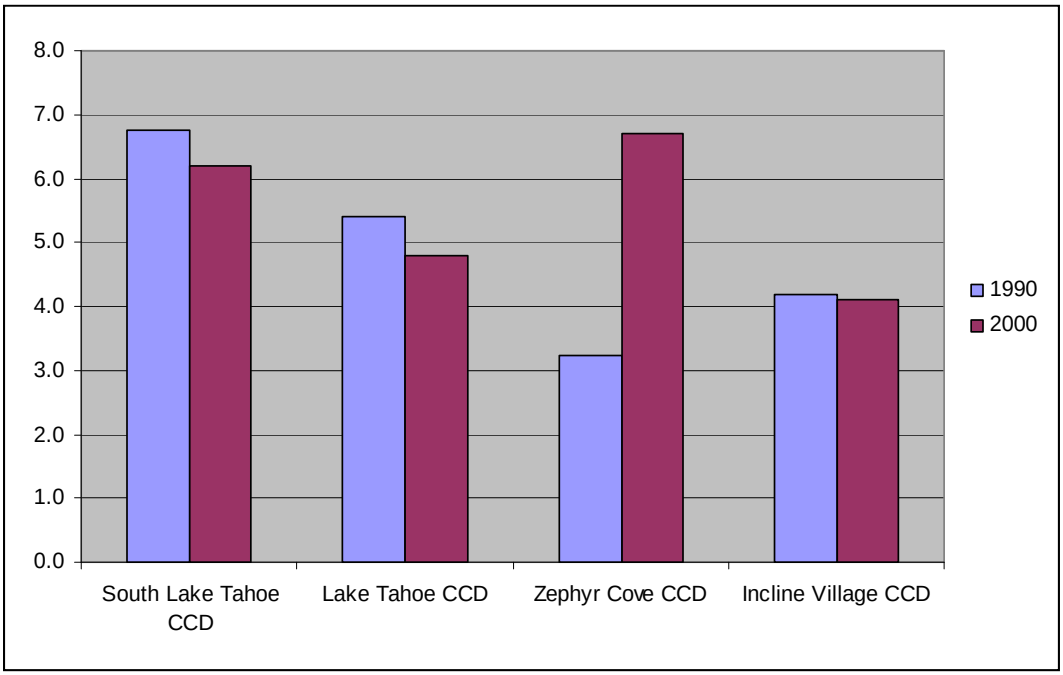


Figure 28 shows that unemployment rates fell in all CCDs but the Zephyr Cove CCD, which in 1990 had the lowest unemployment rate of the CCDs but by 2000 had the highest.

FIGURE 28: Trends in Unemployment Rates, Lake Tahoe Region, 1990- 2000.



Income

Public administration, followed by construction, then health care and social assistance provided the greatest amount of income by industry in the GLTA in 2003 (Figure 29). Within the Lake Tahoe Region in 2006, the accommodation and food services accounted for the greatest share of labor income, followed closely by government (Figure 30).

FIGURE 29: Income by Industry, Regional, 2003.

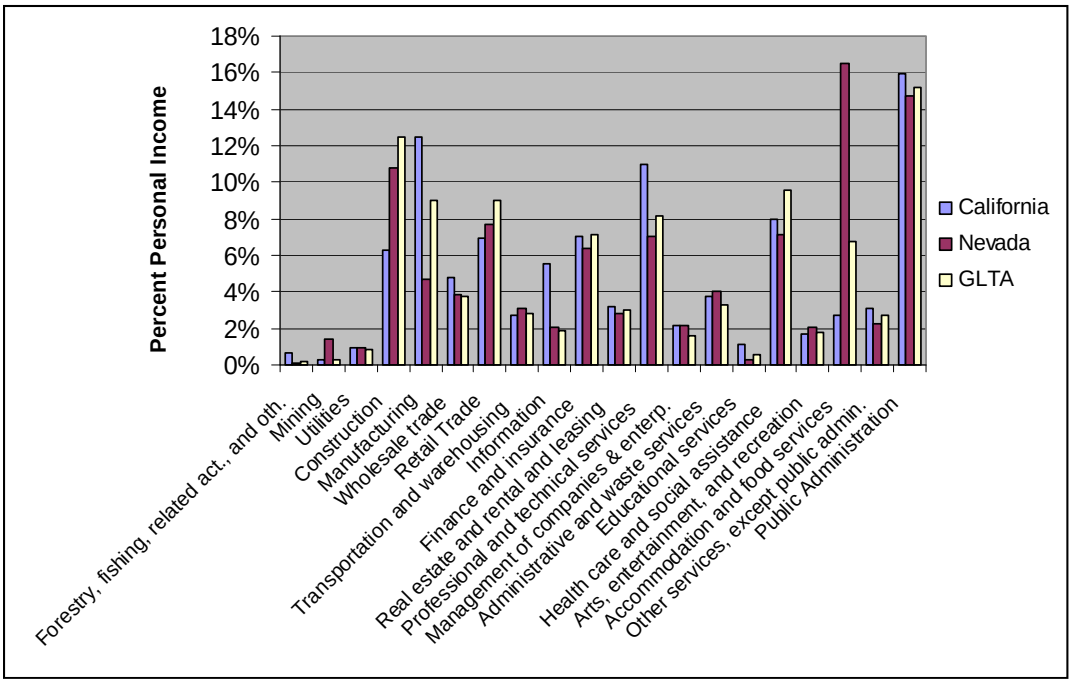
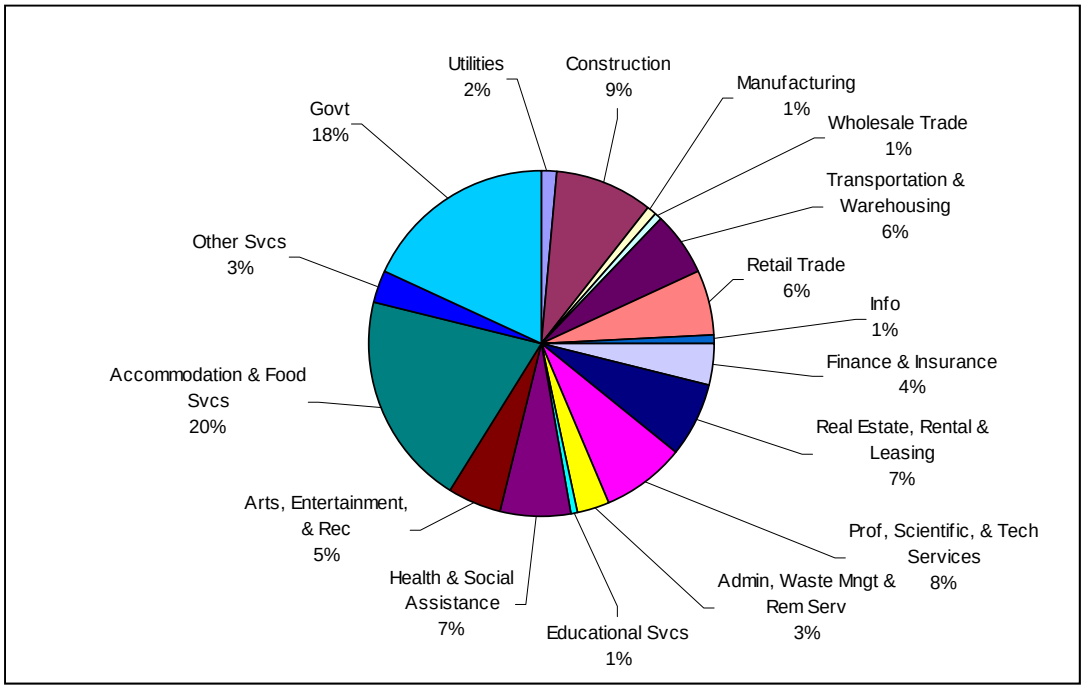
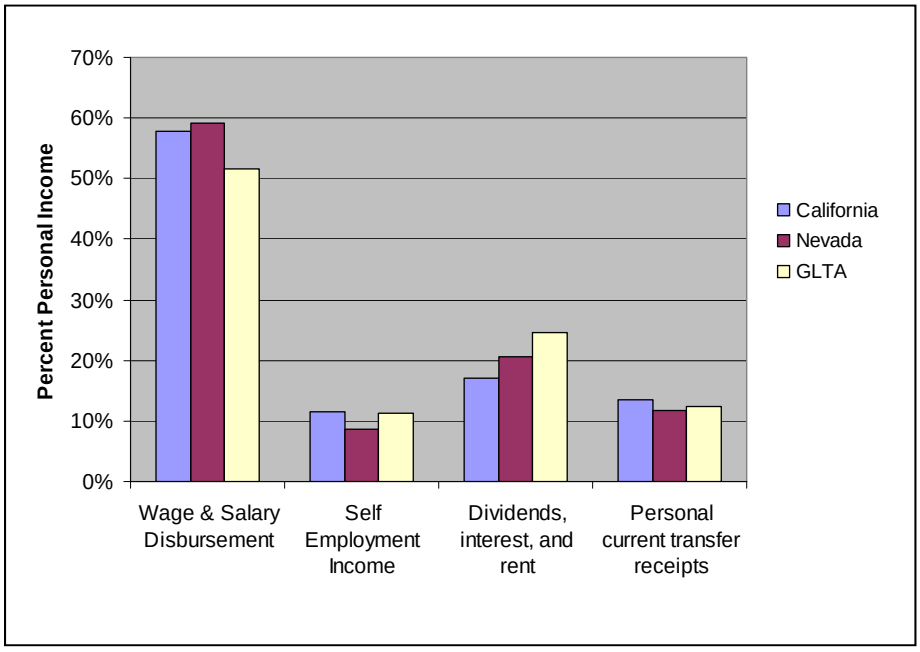


FIGURE 30: Labor Income by Industry Sector, Lake Tahoe Region, 2006.



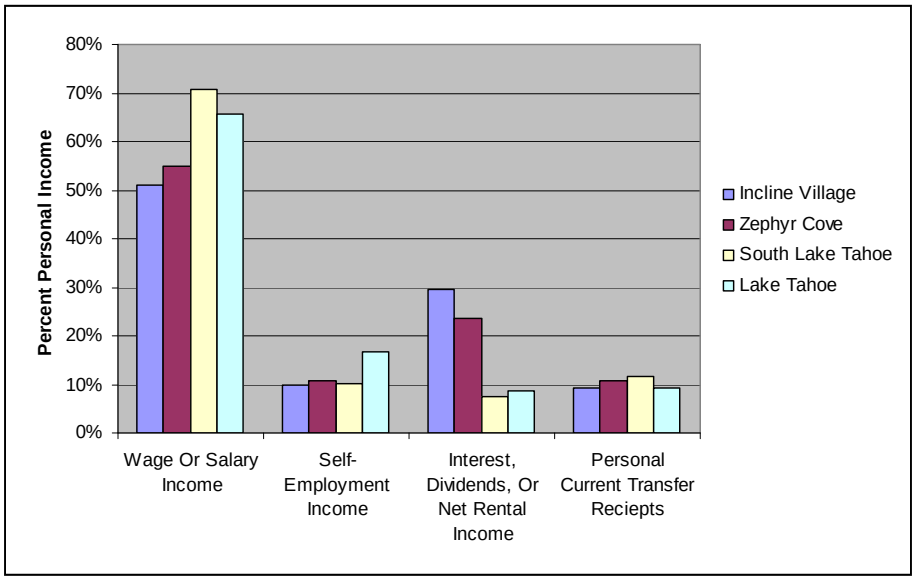
The GLTA differed from California and Nevada by having a greater share of income derived from dividends, interest, and rent than the two states, and a lesser share of personal income coming from wage and salary disbursements.

FIGURE 31: Income by Labor Sector, Regional, 2003.



Income derived from the wage or salary income labor sector was the dominant source of income across all communities in the Lake Tahoe Region. On average, LTR communities in California derived 69% of personal income from wage and salary positions, compared to Nevada LTR communities where 52% of personal income was from wage and salary positions. In turn, 28% of personal income in Nevada LTR communities was earned through interest, dividends, or net rental income, while in California this sector only accounted for 8% of personal income.

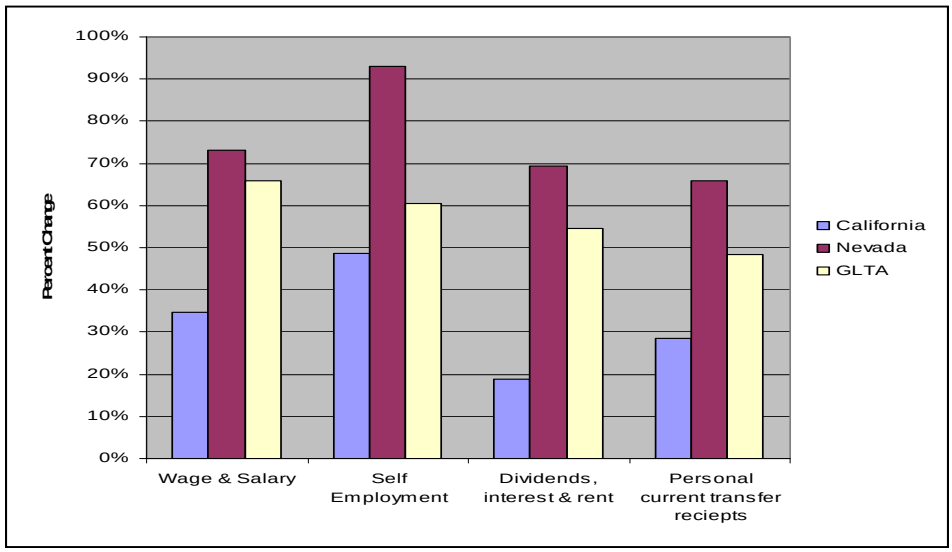
FIGURE 32: Income by Labor Sector, Lake Tahoe Region CCDs, 2003.



Employment Trends

Of the four labor sectors, wage and salary positions grew the fastest in the GLTA. For both Nevada and California, the fastest growing labor sector was self-employment.

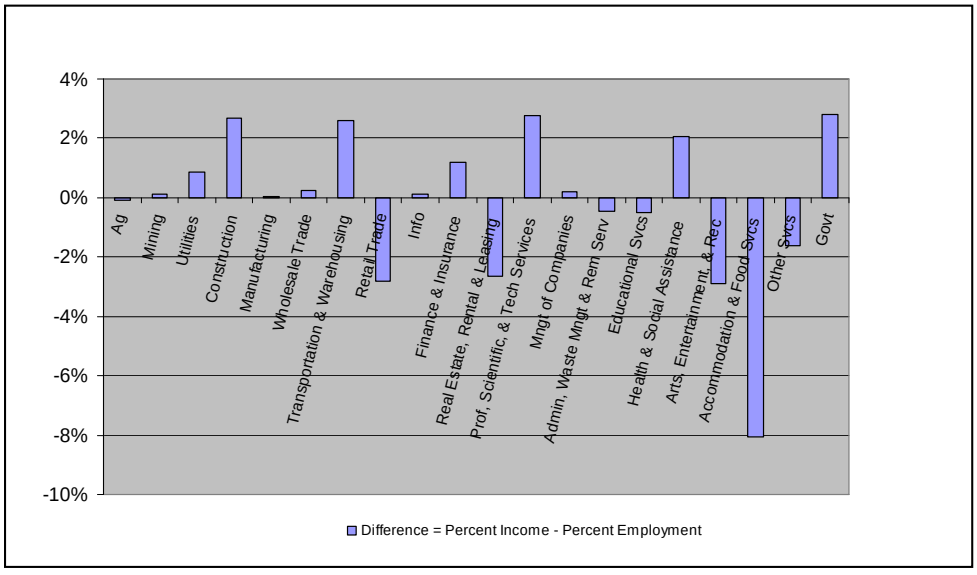
FIGURE 33: Percent Change in Personal Income by Labor Sector, Regional, 1993-2003.



Employment Discussion

Although accommodation and food services occupy more than a quarter of the employment opportunities in the Lake Tahoe Region (Figure 26), they represent only one fifth of the labor income (Figure 30), which means that the greatest portion of employment opportunities in the Lake Tahoe Region are low paying positions. In contrast, the second largest industry sector by employment is government, which occupies 15% of the employment opportunities and provides 18% of the labor income. Figure 34 illustrates the relationship between industry sectors in the Lake Tahoe Region and whether each sector's employment proportion is higher or lower than the proportion of wages.

FIGURE 34: Relative Income by Industry, Lake Tahoe Region, 2006.



Unit Economic Contribution Analysis

Methodology

An economic contribution analysis depicts the Forest Service's contribution to the local and regional economy. An economic contribution analysis differs from an impact analysis in that it does not report the economy-wide effects of some anticipated change but rather provides a snapshot of all the income, jobs, and industries in an area that are related to National Forest resource management. A contribution analysis provides a description of the structure, size, and dynamics of the current economy and the Forest Service's contribution to it.

Non-market benefits such as ecosystem services or social benefits are not captured in the economic contribution analysis. While non-market benefits such as carbon sequestration, scenic beauty, or opportunities for solitude are important, there is no accepted methodology on how to quantify these values. While the Forest Service does recognize the role of ecosystem services, it has yet to establish a formal policy and protocol on whether or how to quantify these values. For these reasons, non-market benefits are captured in the social assessment section above.

IMPLAN is the economic modeling tool created by the Forest Service in cooperation with the Federal Emergency Management Agency and the Bureau of Land Management that was used to estimate the Forest's contribution to the local economy. Originally developed to assist land managers in planning, IMPLAN has since been privatized and is currently run by the Minnesota IMPLAN Group (MIG). IMPLAN models the economic stimulus, i.e., the labor and income generated among 509 economic sectors identified in the North American Industrial Classification System (NAICS) within the study area. The economic sectors were aggregated by the first two digits of their classification number for report purposes to produce twenty aggregate sectors.

Study Area

One of the most important decisions to be made in this type of analysis is the definition of a study area based on a functional local economy. The model built for the LTBMU is based on zip codes, which concentrate on the physical boundary of the Basin. This determination is driven by issues raised by the public and resource managers during the Forest Plan revision process. The Lake Tahoe region is well defined by the mountain ridges around the lake.

The zip codes listed in Table 3 were used to model the "Lake Tahoe Region" economy.

TABLE 3: Zip Codes for Economic Analysis for the Lake Tahoe Region.

STATE	COUNTY	ZIP CODE	CITY/TOWN
NV	Washoe	89402	Crystal Bay, NV
NV	Douglas	89413	Glenbrook, NV
NV	Douglas	89448	Zephyr Cove, NV
NV	Douglas	89449	Stateline, NV
NV	Washoe	89450	Incline Village, NV
NV	Washoe	89451	Incline Village, NV

STATE	COUNTY	ZIP CODE	CITY/TOWN
NV	Washoe	89452	Incline Village, NV
NV	Carson City	89703	Carson City, NV
CA	Placer	96140	Carnellian Bay, CA
CA	Placer	96141	Homewood, CA
CA	El Dorado	96142	Tahoma, CA
CA	Placer	96143	Kings Beach, CA
CA	Placer	96145	Tahoe City, CA
CA	Placer	96146	Olympic Valley, CA
CA	Placer	96148	Tahoe Vista, CA
CA	El Dorado	96150	South Lake Tahoe, CA
CA	El Dorado	96151	South Lake Tahoe, CA
CA	El Dorado	96152	South Lake Tahoe, CA
CA	El Dorado	96154	South Lake Tahoe, CA
CA	El Dorado	96155	South Lake Tahoe, CA
CA	El Dorado	96156	South Lake Tahoe, CA
CA	El Dorado	96157	South Lake Tahoe, CA
CA	El Dorado	96158	South Lake Tahoe, CA

Once the base economic model was built with IMPLAN, the following 'Response Coefficients', or rates of economic activity, were estimated:

Recreation: The local economic stimulus for every million dollars of non-local visitor expenditures while visiting the LTBMU.

Wildlife and Fish: The local economic stimulus for every million dollars of non-local visitor expenditures related to hunting, fishing, and wildlife watching while visiting the LTBMU.

Ecosystem Restoration: The acres of mechanical thinning and small openings created for ecosystem restoration.

Forest Service Expenditures: The local economic stimulus for every million dollars of salary and non-salary expenditures to carry out recreation management activities on the LTBMU.

The response coefficients were then imported into "FEAST", an economic analysis tool developed for forest planning, along with baseline economic data and resource data to generate the economic contribution report. The following data on forest-related activities and management were used to support the development of the report.

Recreation and Wildlife and Fish:

- Annual visitors to the LTBMU by activity and by origin (local or non-local) from the National Visitor Use Monitoring (NVUM) survey for the Lake Tahoe Basin Management Unit, 2007.
- Expenditure profiles from NVUM (Stynes and White 2007) by activity (including wildlife and fish), type of use (overnight or day use) and by residence (local or non-local).

Forest Service Expenditures:

- Annual budget expenditures including salary and non-salary expenditures from fiscal year 2008 (October 2007 to September 2008).
- Base funding, congressionally-allocated funds
- Southern Nevada Public Land Management Act funds
- Environmental Improvement Project funding
- Erosion control grant funds administered by the LTBMU

LTBMU-related employment and labor income describes the "direct," "indirect," and "induced" economic effects derived from expenditures associated with management activities. A "direct" effect is sales of goods and services by local businesses to National Forest visitors or to the LTBMU. The local purchase of goods and services by directly affected businesses for production purposes is referred to as the "indirect" effect. The local expenditure of income by employees and proprietors of directly and indirectly affected firms is referred to as an "induced" effect.

For example, a visitor who comes to the Lake Tahoe basin for the primary purpose of recreating on National Forest System lands may also purchase accommodations off the forest. This would be a direct effect. Supplies purchased by the hotel to provide that hotel room would represent an indirect effect, and the employees of the hotel who spend their wage on groceries generates an induced effect. Induced and indirect impacts are also referred to as secondary—or ripple—effects. Secondary effects in the local economy can also be described as recirculated monies.

The more times money is circulated within the local economy before it "leaks" out, the greater the economic benefit is to the local economy in terms of income and employment. Leakage refers to when monies are spent outside of the local economy. How effective a community is in increasing the number of times a dollar is recirculated in the local economy is largely affected by the degree of economic diversity. The rate of spending and respending of money in an economy is called the "multiplier effect."

In estimating the LTBMU's economic contribution, it is important to note that when considering the economic contribution of recreation visitors, only non-local visitor expenditures are assessed in Table 4. This is not to say that spending behaviors by local recreationists do not influence the economic vitality of the area, but rather the "substitution effect" is unknown. Substitution effect refers to how spending behaviors would be affected if the LTBMU did not exist. It is conceivable that the local recreationists would find similar local recreation opportunities and their spending behavior would remain the same. In addition, expenditures by locals do not introduce "new money" into the economy.

Current Conditions of Forest Economic Contribution

Table 4 describes the LTBMU's contribution to the Lake Tahoe Basin area as measured by jobs and labor income by industry sector. Note that "Jobs" is average annual employment and includes a combination of full and part time, temporary, and seasonal workers. "Labor Income" is the sum of employee compensation (the value of wages and benefits) and proprietor's income. The numbers in the "LTBMU-related" columns are Total Effects – direct effects plus the ripple (secondary) effects in the local economy.

TABLE 4: LTBMU Economic Contribution to Lake Tahoe Region (2008).

INDUSTRY	EMPLOYMENT (JOBS)		LABOR INCOME (THOUSANDS OF 2010 DOLLARS)	
	AREA TOTALS	FS-RELATED	AREA TOTALS	FS-RELATED
Agriculture	54	55	$2,070	$1,751
Mining	51	6	$2,261	$277
Utilities	199	4	$23,685	$620
Construction	3,287	27	$200,103	$1,588
Manufacturing	242	69	$14,983	$1,979
Wholesale Trade	329	81	$24,169	$6,236
Transportation & Warehousing	654	66	$27,195	$2,842
Retail Trade	3,563	385	$115,344	$14,799
Information	411	32	$26,545	$2,044
Finance & Insurance	2,382	50	$74,893	$2,281
Real Estate & Rental & Leasing	7,594	89	$107,985	$1,592
Prof, Scientific, & Tech Services	3,316	160	$178,494	$7,437
Mngt of Companies	156	16	$18,573	$1,881
Admin, Waste Mngt & Rem Serv	2,189	82	$78,082	$2,717
Educational Services	681	20	$15,962	$726
Health Care & Social Assistance	3,748	95	$239,840	$10,931
Arts, Entertainment, and Rec	2,816	320	$88,447	$10,649
Accommodation & Food Services	10,167	1,784	$316,644	$54,786
Other Services	3,150	77	$125,385	$4,244
Government	7,623	175	$498,144	$14,343
Total	**52,612**	**3,593**	**$2,178,808**	**$143,722**
FS as Percent of Total	**---**	**6.83%**	**---**	**6.60%**

Of the Forest Service programs, the greatest economic stimulus to the GLTA and LTA's economy is due to the recreation program.

Unit Economic Contribution Discussion

Susan Winter, economist and economic modeler working with the Forest Service's Planning Analysis Group (PAG), who ran the IMPLAN model for this analysis, indicated that an economic contribution to the area of analysis of close to 4% is a large contribution in comparison with other National Forests. The typical contribution is 1 - 2%. ***This contribution is relatively large because the LTBMU is one of the smallest forests in the country and has the highest per acre visitor rate.*** As illustrated in numerous tables, the dominant industries in the LTR are related to recreation and tourism. One of the industries most dependent on the LTBMU for economic stimulus is accommodation and food services, which, as noted in the income discussion, is dominated by low wage positions. However, the LTBMU also contributes to relatively high wage positions in its administrative capacity related to the Southern Nevada Public Land Management Act. In addition, the LTBMU receives and administers, on average, $37.5 million in federal funding annually to support environmental improvement projects, which contributes to a large share of the employment and income being related to the government sector.

TABLE 5: Risk Assessment.

CURRENT CONDITION	RISKS	EFFECTS ON MANAGEMENT
The Lake Tahoe Region is highly dependent on tourism. The greatest contribution by the LTBMU is in tourism-related industries.	The Lake Tahoe Region is highly vulnerable to national social, economic, political, and environmental conditions that affect travel and tourism.	Diversify economic opportunities by coordinating with local, county, and state jurisdictions, and economic development organizations to identify and develop small-scale industries dependent on non-timber forest products.
The second greatest contribution of the LTBMU in the LTR is from government expenditures on salary and non-salary items. Much of the operating budget comes from SNPLMA, whose funds are guaranteed through 2012.	There is a great level of uncertainty about what the funding level from SNPLMA will be after 2012. This could translate into a considerably sizeable loss of jobs and labor income.	Eventually the SNPLMA funding will run out, likely in the first decade of the revised Forest Plan (planned publication January 2013). The budget is expected to drop by around half.
The LTBMU's largest contribution to employment and labor income is in low wage positions.	Wages cannot support cost of living for many local employees. Creates community instability.	Create tourism related economic opportunities for small owner-operated businesses that pay higher wages. Increase outfitter and guiding permittee opportunities.

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Appendix X | Mothballing Historic Buildings

Forest Service Prescription for Upper Cabin Complex and Department of Interior Preservation Brief

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Mothballing Prescription for Round Hill Pines Resort Upper Cabin Complex

The following represents a series of prescribed mothballing treatments for facilities located in the upper cabin complex (UCC) of Round Hill Pines Resort. Please note that the Forest Service may make adjustments to these recommendations as conditions change at the site.

To accomplish this work, grant funding opportunities may be available from the Historic Preservation Fund (HPF) (http://www.nps.gov/hps/hpg/hpf/HPF_Manual.htm). In addition, tax incentives may be available through the National Park Service (http://www.nps.gov/tps/tax-incentives.htm).

Site Safety Concerns

The objective of this level of work at the site is to allow the public to walk within the UCC site safely.

Utilities

Electrical conductors shall be removed from the ground surface, trees, and from the exterior of all buildings. Water pipe shall be abandoned in place if buried beneath the ground surface by at least 6 inches. In locations where water pipes are above ground, the pipe and plumbing appurtenances shall be removed from the site to the point 6 inches below where the pipes enter the ground.

Site Appurtenances

All hazard trees and exterior timber framed decks for all buildings shall be removed. Remove all welded wire, barb wire, and timber fencing including posts and fencing material. Collect and dispose of trash, glass, and loose brick from site.

Windows and Doors

All window and door openings shall be secured using 5/8" inch T1-11 plywood siding with 4-inch grooves. Grooves shall be oriented vertically and T1-11 shall be secured with deck screws placed 6 inches on center. Perimeter of T1-11 shall be framed with 1x6 lumber to make the appearance that windows and doors are secured with shutters. The T1-11 and 1x6 lumber shall be painted to match the color of each building.

Siding

Install new corrugated metal siding to match the existing material type on the boiler building.

Protection of Structure

The objective of this level of work is to protect the structure from the elements and retain the current condition of the building. Refer to the table below for a summary of tasks for each of the 14 structures.

Foundation

Raise and level the concrete slab beneath the southwest corner of the ice house building. Once level, place and compact granular fill beneath the concrete and extend the fill level to a distance of at least 24 inches beyond the edge of the building. Beyond this point, taper the fill at a slope of 3 horizontal to 1 vertical.

Roofing

Repair roof framing in all locations where structural integrity has been compromised. Existing roof sheathing shall be removed and replaced with new ½" OSB sheathing. The only exception is the log lodge, ice house, and boiler building roofs need not be replaced. Install self-adhering polymer modified bitumen sheeting on the entire roof surface directly to new OSB. Install continuous 2x4 battens lined up over each roof rafter on top of the bitumen sheeting. 1x6 spaced sheathing shall then be secured to the 2x4 battens. Install new roofing to the 1x6 sheathing using either No. 1 cedar or redwood shakes and No. 1 shingles. Fire-retardant-treated wood shakes and shingles shall be treated by impregnation with chemicals by the full-cell vacuum-pressure process, in accordance with AWPA C1. The installation techniques for all sheathing and roofing shall meet the provisions of IBC 2009 including Chapter 15.

STRUCTURE	QUANTITY	FOUNDATION REPAIR	REMOVE DECKS	NEW ROOFS	REPAIR SIDING
Log Lodge	1	No	No	No	No
Ice House	1	Yes	Yes	No	No
Boiler	1	No	No	No	Yes
Cabins	11	No	Yes	Yes	No

Occupancy

Once the purpose and occupancy of any building is defined, the condition of the building shall be assessed and evaluated for conformance with provisions identified in the latest version of the International Building Code. Any repairs or modifications to each building will be dependent on the occupancy of the building and provisions in the International Building Code, but may include new foundations and the installation of a fire sprinkler system.

31 Preservation Briefs
Technical Preservation Services
National Park Service
U.S. Department of the Interior

Mothballing Historic Buildings

Sharon C. Park, AIA

A NOTE TO OUR USERS: The web versions of the **Preservation Briefs** differ somewhat from the printed versions. Many illustrations are new, captions are simplified, illustrations are typically in color rather than black and white, and some complex charts have been omitted.

When all means of finding a productive use for a historic building have been exhausted or when funds are not currently available to put a deteriorating structure into a useable condition, it may be necessary to close up the building temporarily to protect it from the weather as well as to secure it from vandalism. This process, known as mothballing, can be a necessary and effective means of protecting the building while planning the property's future, or raising money for a preservation, rehabilitation or restoration project. If a vacant property has been declared unsafe by building officials, stabilization and mothballing may be the only way to protect it from demolition.

This building has been successfully mothballed for 10 years because the roof and walls were repaired and structurally stabilized, ventilation louvers added, and the property maintained. Photo: NPS files.

This Preservation Brief focuses on the steps needed to "de-activate" a property for an extended period of time. The project team will usually consist of an architect, historian, preservation specialist, sometimes a structural engineer, and a contractor. Mothballing should not be done without careful planning to ensure that needed physical repairs are made prior to securing the building. The steps discussed in this Brief can protect buildings for periods of up to ten years; long-term success will also depend on continued, although somewhat limited, monitoring and maintenance. For all but the simplest projects, hiring a team of preservation specialists is recommended to assess the specific needs of the structure and to develop an effective mothballing program.

A vacant historic building cannot survive indefinitely in a boarded-up condition, and so even marginal interim uses where there is regular activity and monitoring, such as a caretaker residence or non-flammable storage, are generally preferable to mothballing.

In a few limited cases when the vacant building is in good condition and in a location where it can be watched and checked regularly, closing and locking the door, setting heat levels at just above freezing, and securing the windows may provide sufficient protection for a period of a few years.

But if long-term mothballing is the only remaining option, it must be done properly. This will require stabilization of the exterior, properly designed security protection, generally some form of interior ventilation--either through mechanical or natural air exchange systems--and continued maintenance and surveillance monitoring.

Boarding up without adequate ventilation and maintenance has accelerated deterioration of this property. Photo: NPS files.

Comprehensive mothballing programs are generally expensive and may cost 10% or more of a modest rehabilitation budget. However, the money spent on well-planned protective measures will seem small when amortized over the life of the resource. Regardless of the location and condition of the property or the funding available, the following 9 steps are involved in properly mothballing a building:

Documentation

1. Document the architectural and historical significance of the building.
2. Prepare a condition assessment of the building.

Stabilization

3. Structurally stabilize the building, based on a professional condition assessment.
4. Exterminate or control pests, including termites and rodents.
5. Protect the exterior from moisture penetration.

Mothballing

6. Secure the building and its component features to reduce vandalism or break-ins. 7. Provide adequate ventilation to the interior.
8. Secure or modify utilities and mechanical systems.
9. Develop and implement a maintenance and monitoring plan for protection.

These steps will be discussed in sequence below. Documentation and stabilization are critical components of the process and should not be skipped over. Mothballing measures should not result in permanent damage, and so each treatment should be weighed in terms of its reversibility and its overall benefit.

Documentation

Documenting the historical significance and physical condition of the property will provide information necessary for setting priorities and allocating funds. The project team should be cautious when first entering the structure if it has been vacant or is

deteriorated. It may be advisable to shore temporarily areas appearing to be structurally unsound until the condition of the structure can be fully assessed. If pigeon or bat droppings, friable asbestos or other health hazards are present, precautions must be taken to wear the appropriate safety equipment when first inspecting the building. Consideration should be given to hiring a firm specializing in hazardous waste removal if these highly toxic elements are found in the building.

Documenting and recording the building

Documenting a building's history is important because evidence of its true age and architectural significance may not be readily evident. The owner should check with the State Historic Preservation Office or local preservation commission for assistance in researching the building. If the building has never been researched for listing in the National Register of Historic Places or other historic registers, then, at a minimum, the following should be determined:

The overall historical significance of the property and dates of construction;

The chronology of alterations or additions and their approximate dates; and,

Types of building materials, construction techniques, and any unusual detailing or regional variations of craftsmanship.

Old photographs can be helpful in identifying early or original features that might be hidden under modern materials. On a walk-through, the architect, historian, or preservation specialist should identify the architecturally significant elements of the building, both inside and out.

Documenting a building's history and assessing its condition provide information to set priorities for stabilization and repair, prior to mothballing. Photo: NPS files.

By understanding the history of the resource, significant elements, even though deteriorated, may be spared the trash pile. For that reason alone, any materials removed from the building or site as part of the stabilization effort should be carefully scrutinized and, if appearing historic, should be photographed, tagged with a number, inventoried, and safely stored, preferably in the building, for later retrieval.

A site plan and schematic building floor plans can be used to note important information for use when the building is eventually preserved, restored, or rehabilitated. Each room should be given a number and notations added to the plans regarding the removal of important features to storage or recording physical treatments undertaken as part of the stabilization or repair.

Because a mothballing project may extend over a long period of time, with many different people involved, clear records should be kept and a building file established. Copies of all important data, plans, photographs, and lists of consultants or contractors who have worked on the property should be added to the file as the job progresses. Recording actions taken on the building and identifying where elements that have been removed are stored will be helpful in the future.

The project coordinator should keep the building file updated and give duplicate copies

to the owner. A list of emergency numbers, including the number of the key holder, should be kept at the entrance to the building or on a security gate, in a transparent vinyl sleeve.

Preparing a condition assessment of the building

A condition assessment can provide the owner with an accurate overview of the current condition of the property. If the building is deteriorated or if there are significant interior architectural elements that will need special protection during the mothballing years, undertaking a condition assessment is highly recommended, but it need not be exhaustive.

A modified condition assessment, prepared by an architect or preservation specialist, and in some case a structural engineer, will help set priorities for repairs necessary to stabilize the property for both the short and long-term. It will evaluate the age and condition of the following major elements: foundations; structural systems; exterior materials; roofs and gutters; exterior porches and steps; interior finishes; staircases; plumbing, electrical, mechanical systems; special features such as chimneys; and site drainage.

To record existing conditions of the building and site, it will be necessary to clean debris from the building and to remove unwanted or overgrown vegetation to expose foundations. The interior should be emptied of its furnishing (unless provisions are made for mothballing these as well), all debris removed, and the interior swept with a broom. Building materials too deteriorated to repair, or which have come detached, such as moldings, balusters, and decorative plaster, and which can be used to guide later preservation work, should be tagged, labeled and saved.

Buildings seriously damaged by storms or deterioration may need to be braced before architectural evaluations can be made. Photo: John Milner Architects. Photo: NPS files

Photographs or a videotape of the exterior and all interior spaces of the resource will provide an invaluable record of "as is" conditions. If a videotape is made, oral commentary can be provided on the significance of each space and architectural feature. If 35mm photographic prints or slides are made, they should be numbered, dated, and appropriately identified. Photographs should be cross-referenced with the room numbers on the schematic plans. A systematic method for photographing should be developed; for example, photograph each wall in a room and then take a corner shot to get floor and ceiling portions in the picture. Photograph any unusual details as well as examples of each window and door type.

For historic buildings, the great advantage of a condition assessment is that architectural features, both on the exterior as well as the interior, can be rated on a scale of their importance to the integrity and significance of the building. Those features of the highest priority should receive preference when repairs or protection measures are outlined as part of the mothballing process. Potential problems with protecting these features should be identified so that

Loose or detached elements should be identified, tagged and stored, preferably on site. Photo: NPS files

appropriate interim solutions can be selected. For example, if a building has always been heated and if murals, decorative plaster walls, or examples of patterned wall paper are identified as highly significant, then special care should be taken to regulate the interior climate and to monitor it adequately during the mothballing years. This might require retaining electrical service to provide minimal heat in winter, fan exhaust in summer, and humidity controls for the interior.

Stabilization

Stabilization as part of a mothballing project involves correcting deficiencies to slow down the deterioration of the building while it is vacant. Weakened structural members that might fail altogether in the forthcoming years must be braced or reinforced; insects and other pests removed and discouraged from returning; and the building protected from moisture damage both by weatherizing the exterior envelope and by handling water run-off on the site. Even if a modified use or caretaker services can eventually be found for the building, the following steps should be addressed.

Structurally stabilizing the building

While bracing may have been required to make the building temporarily safe for inspection, the condition assessment may reveal areas of hidden structural damage. Roofs, foundations, walls, interior framing, porches and dormers all have structural components that may need added reinforcement.

Interior bracing which will last the duration of the mothballing will protect weakened structural members. Photo: John Milner Architects.

Structural stabilization by a qualified contractor should be done under the direction of a structural engineer or a preservation specialist to ensure that the added weight of the reinforcement can be sustained by the building and that the new members do not harm historic finishes. Any major vertical post added during the stabilization should be properly supported and, if necessary, taken to the ground and underpinned.

If the building is in a northern climate, then the roof framing must be able to hold substantial snow loads. Bracing the roof at the ridge and mid-points should be considered if sagging is apparent. Likewise, interior framing around stair openings or under long ceiling spans should be investigated. Underpinning or bracing structural piers weakened by poor drainage patterns may be a good precaution as well. Damage caused by insects, moisture, or from other causes should be repaired or reinforced and, if possible, the source of the damage removed. If features such as porches and dormers are so severely deteriorated that they must be removed, they should be documented, photographed, and portions salvaged for storage prior to removal.

If the building is in a southern or humid climate and termites or other insects are a particular problem, the foundation and floor framing should be inspected to ensure that there are no major structural weaknesses. This can usually be done by observation from

the crawl space or basement. For those structures where this is not possible, it may be advisable to lift selective floor boards to expose the floor framing. If there is evidence of pest damage, particularly termites, active colonies should be treated and the structural members reinforced or replaced, if necessary.

Controlling pests

Pests can be numerous and include squirrels, raccoons, bats, mice, rats, snakes, termites, moths, beetles, ants, bees and wasps, pigeons, and other birds. Termites, beetles, and carpenter ants destroy wood. Mice, too, gnaw wood as well as plaster, insulation, and electrical wires. Pigeon and bat droppings not only damage wood finishes but create a serious and sometimes deadly health hazard.

If the property is infested with animals or insects, it is important to get them out and to seal off their access to the building. If necessary, exterminate and remove any nests or hatching colonies. Chimney flues may be closed off with exterior grade plywood caps, properly ventilated, or protected with framed wire screens. Existing vents, grills, and louvers in attics and crawl spaces should be screened with bug mesh or heavy duty wire, depending on the type of pest being controlled. It may be advantageous to have damp or infected wood treated with insecticides (as permitted by each state) or preservatives, such as borate, to slow the rate of deterioration during the time that the building is not in use.

Securing the exterior envelope from moisture penetration

It is important to protect the exterior envelope from moisture penetration before securing the building. Leaks from deteriorated or damaged roofing, from around windows and doors, or through deteriorated materials, as well as ground moisture from improper site run-off or rising damp at foundations, can cause long-term damage to interior finishes and structural systems. Any serious deficiencies on the exterior, identified in the condition assessment, should be addressed.

Regrading has protected this masonry foundation wall from excessive damp during its 10-year mothballing. Note the attic and basement vents, temporary stairs, and interpretive sign. Photo: NPS files.

To the greatest extent possible, these weatherization efforts should not harm historic materials. The project budget may not allow deteriorated features to be fully repaired or replaced in-kind. Non-historic or modern materials may be used to cover historic surfaces temporarily, but these treatments should not destroy valuable evidence necessary for future preservation work. Temporary modifications should be as visually compatible as possible with the historic building.

Roofs are often the most vulnerable elements on the building exterior and yet in some ways they are the easiest element to stabilize for the long term, if done correctly. "Quick fix" solutions, such as tar patches on slate roofs, should be avoided as they will generally fail within a year or so and may accelerate damage by trapping moisture. They are difficult to undo later when more permanent repairs are undertaken. Use of a tarpaulin over a leaking roof should be thought of only as a very temporary emergency repair because it is often blown off by the wind in a subsequent storm.

If the existing historic roof needs moderate repairs to make it last an additional ten years, then these repairs should be undertaken as a first priority. Replacing cracked or missing shingles and tiles, securing loose flashing, and reanchoring gutters and downspouts can often be done by a local roofing contractor. If the roof is in poor condition, but the historic materials and configuration are important, a new temporary roof, such as a lightweight aluminum channel system over the existing, might be considered. If the roofing is so deteriorated that it must be replaced and a lightweight aluminum system is not affordable, various inexpensive options might be considered. These include covering the existing deteriorated roof with galvanized corrugated metal roofing panels, or 90 lb. rolled roofing, or a rubberized membrane (refer back to cover photo). These alternatives should leave as much of the historic sheathing and roofing in place as evidence for later preservation treatments.

Urban buildings often need additional protection from unwanted entry and graffiti. This commercial building uses painted plywood panels to cover its glass storefronts. The upper windows on the street sides have been painted to resemble 19th century sash. Photo: NPS files.

For masonry repairs, appropriate preservation approaches are essential. For example, if repointing deteriorated brick chimneys or walls is necessary to prevent serious moisture penetration while the building is mothballed, the mortar should match the historic mortar in composition, color, and tooling. The use of hard portland cement mortars or vapor-impermeable waterproof coatings are not appropriate solutions as they can cause extensive damage and are not reversible treatments.

For wood siding that is deteriorated, repairs necessary to keep out moisture should be made; repainting is generally warranted. Cracks around windows and doors can be beneficial in providing ventilation to the interior and so should only be caulked if needed to keep out bugs and moisture. For very deteriorated wall surfaces on wooden frame structures, it may be necessary to sheathe in plywood panels, but care should be taken to minimize installation damage by planning the location of the nailing or screw patterns or by installing panels over a frame of battens. Generally, however, it is better to repair deteriorated features than to cover them over.

Foundation damage may occur if water does not drain away from the building. Run-off from gutters and downspouts should be directed far away from the foundation wall by using long flexible extender pipes equal in length to twice the depth of the basement or crawl space. If underground drains are susceptible to clogging, it is recommended that the downspouts be disconnected from the drain boot and attached to flexible piping. If gutters and downspouts are in bad condition, replace them with inexpensive aluminum units.

If there are no significant landscape or exposed archeological elements around the foundation, consideration should be given to regrading the site if there is a documented drainage problem. If building up the grade, use a fiber mesh membrane to separate the new soil from the old and slope the new soil 6 to 8 feet (200 cm-266 cm) away from the foundation making sure not to cover up the dampcourse layer or come into contact with skirting boards. To keep vegetation under control, put down a layer of 6 mil black polyethylene sheeting or fiber mesh matting covered with a 2"-4" (5-10 cm.) of washed gravel. If the building suffers a serious rising damp problem, it may be advisable to eliminate the plastic sheeting to avoid trapping ground moisture against foundations.

Mothballing

The actual mothballing effort involves controlling the long-term deterioration of the building while it is unoccupied as well as finding methods to protect it from sudden loss by fire or vandalism. This requires securing the building from unwanted entry, providing adequate ventilation to the interior, and shutting down or modifying existing utilities. Once the building is de-activated or secured, the long-term success will depend on periodic maintenance and surveillance monitoring.

Securing the building from vandals, break-ins, and natural disasters

Securing the building from sudden loss is a critical aspect of mothballing. Because historic buildings are irreplaceable, it is vital that vulnerable entry points are sealed. If the building is located where fire and security service is available then it is highly recommended that some form of monitoring or alarm devices be used.

To protect decorative features, such as mantels, lighting fixtures, copper downspouts, iron roof cresting, or stained glass windows from theft or vandalism, it may be advisable to temporarily remove them to a more secure location if they cannot be adequately protected within the structure.

The first floor openings of this historic building have been filled with cinder blocks and the doors, window sash, and frames removed for safe keeping. The security metal door features heavy duty locks. Photo: NPS files.

Mothballed buildings are usually boarded up, particularly on the first floor and basement, to protect fragile glass windows from breaking and to reinforce entry points. Infill materials for closing door and window openings include plywood, corrugated panels, metal grates, chain fencing, metal grills, and cinder or cement blocks. The method of installation should not result in the destruction of the opening and all associated sash, doors, and frames should be protected or stored for future reuse.

Generally exterior doors are reinforced and provided with strong locks, but if weak historic doors would be damaged or disfigured by adding reinforcement or new locks, they may be removed temporarily and replaced with secure modern doors. Alternatively, security gates in an new metal frame can be installed within existing door openings, much like a storm door, leaving the historic door in place. If plywood panels are installed over door openings, they should be screwed in place, as opposed to nailed, to avoid crowbar damage each time the panel is removed. This also reduces pounding vibrations from hammers and eliminates new nail holes each time the panel is replaced.

For windows, the most common security feature is the closure of the openings; this may be achieved with wooden or pre-formed panels or, as needed, with metal sheets or concrete blocks. Plywood panels, properly installed to protect wooden frames and properly ventilated, are the preferred treatment from a preservation standpoint.

There are a number of ways to set insert plywood panels into

This painted trompe l'eoil scene on plywood panels is a neighborhood-friendly device. Photo: NPS files.

windows openings to avoid damage to frame and sash. One common method is to bring the upper and lower sash of a double hung unit to the mid-point of the opening and then to install pre-cut plywood panels using long carriage bolts anchored into horizontal wooden bracing, or strong backs, on the inside face of the window. Another means is to build new wooden blocking frames set into deeply recessed openings, for example in an industrial mill or warehouse, and then to affix the plywood panel to the blocking frame. If sash must be removed prior to installing panels, they should be labeled and stored safely within the building.

Plywood panels are usually 1/2"-3/4" (1.25-1.875 cm.) thick and made of exterior grade stock, such as CDX, or marine grade plywood. They should be painted to protect them from delamination and to provide a neater appearance.

These panels may be painted to resemble operable windows or treated decoratively. With extra attention to detail, the plywood panels can be trimmed out with muntin strips to give a shadow line simulating multi-lite windows. This level of detail is a good indication that the building is protected and valued by the community.

If the building has shutters simply close the shutters and secure them from the interior. If the building had shutters historically, but they are missing, it may be appropriate to install new shutters, even in a modern material, and secure them in the closed position. Louvered shutters will help with interior ventilation if the sash are propped open behind the shutters.

There is some benefit from keeping windows unboarded if security is not a problem. The building will appear to be occupied, and the natural air leakage around the windows will assist in ventilating the interior. The presence of natural light will also help when periodic inspections are made. Rigid polycarbonate clear storm glazing panels may be placed on the window exterior to protect against glass breakage. Because the sun's ultraviolet rays can cause fading of floor finishes and wall surfaces, filtering pull shades or inexpensive curtains may be options for reducing this type of deterioration for significant interiors. Some acrylic sheeting comes with built-in ultraviolet filters.

A view showing the exterior of the Brearley House, New Jersey, in its mothballed condition Photo: Michael Mills, Ford Farewell Mills Gatsch, Architects.

Securing the building from catastrophic destruction from fire, lightning, or arson will require additional security devices. Lightning rods properly grounded should be a first consideration if the building is in an area susceptible to lightning storms. A high security fence should also be installed if the property cannot be monitored closely. These interventions do not require a power source for operation. Since many buildings will not maintain electrical power, there are some devices available using battery packs, such as intrusion alarms, security lighting, and smoke detectors which through audible horn alarms can alert nearby neighbors. These battery packs must be replaced every 3 months to 2 years, depending on type and use. In combination with a cellular

phone, they can also provide some level of direct communication with police and fire departments.

If at all possible, new temporary electric service should be provided to the building. Generally a telephone line is needed as well. A hard wired security system for intrusion and a combination rate-of-rise and smoke detector can send an immediate signal for help directly to the fire department and security service. Depending on whether or not heat will be maintained in the building, the security system should be designed accordingly. Some systems cannot work below 32°F (0°C). Exterior lighting set on a timer, photo electric sensor, or a motion/infra-red detection device provides additional security.

Providing adequate ventilation to the interior

Once the exterior has been made weathertight and secure, it is essential to provide adequate air exchange throughout the building. Without adequate air exchange, humidity may rise to unsafe levels, and mold, rot, and insect infestation are likely to thrive. The needs of each historic resource must be individually evaluated because there are so many variables that affect the performance of each interior space once the building has been secured.

A mechanical engineer or a specialist in interior climates should be consulted, particularly for buildings with intact and significant interiors. In some circumstances, providing heat during the winter, even at a minimal 45° F (7°C), and utilizing forced-fan ventilation in summer will be recommended and will require retaining electrical service. For masonry buildings it is often helpful to keep the interior temperature above the spring dew point to avoid damaging condensation. In most buildings it is the need for summer ventilation that outweighs the winter requirements.

This exhaust fan has tamper-proof housing. Photo: Michael Mills, Ford Farewell Mills Gatsch, Architects.

Many old buildings are inherently leaky due to loose-fitting windows and floorboards and the lack of insulation. The level of air exchange needed for each building, however, will vary according to geographic location, the building's construction, and its general size and configuration.

There are four critical climate zones when looking at the type and amount of interior ventilation needed for a closed up building: hot and dry (southwestern states); cold and damp (Pacific northwest and northeastern states); temperate and humid (Mid-Atlantic states, coastal areas); and hot and humid (southern states and the tropics).

Once closed up, a building interior will still be affected by the temperature and humidity of the exterior. Without proper ventilation, moisture from condensation may occur and cause damage by wetting plaster, peeling paint, staining woodwork, warping floors, and in some cases even causing freeze thaw damage to plaster. If moist conditions persist in a property, structural damage can result from rot or returning insects attracted to moist conditions. Poorly mothballed masonry buildings, particularly in damp and humid zones have been so damaged on the interior with just one year of unventilated closure that none of the interior finishes were salvageable when the buildings were rehabilitated.

Portable monitors are used to record temperature and humidity conditions in historic buildings during mothballing. Photo: NPS files.

The absolute minimum air exchange for most mothballed buildings consists of one to four air exchanges every hour; one or two air exchanges per hour in winter and twice that amount in summer. Even this minimal exchange may foster mold and mildew in damp climates, and so monitoring the property during the stabilization period and after the building has been secured will provide useful information on the effectiveness of the ventilation solution.

There is no exact science for how much ventilation should be provided for each building. There are, however, some general rules of thumb. Buildings, such as adobe structures, located in hot and arid climates may need no additional ventilation if they have been well weatherized and no moisture is penetrating the interior. Also frame buildings with natural cracks and fissures for air infiltration may have a natural air exchange rate of 3 or 4 per hour, and so in arid as well as temperate climates may need no additional ventilation once secured. The most difficult buildings to adequately ventilate without resorting to extensive louvering and/or mechanical exhaust fan systems are masonry buildings in humid climates. Even with basement and attic vent grills, a masonry building many not have more than one air exchange an hour. This is generally unacceptable for summer conditions. For these buildings, almost every window opening will need to be fitted out with some type of passive, louvered ventilation.

Depending on the size, plan configuration, and ceiling heights of a building, it is often necessary to have louvered opening equivalent to 5%-10% of the square footage of each floor. For example, in a hot humid climate, a typical 20'x30' (6.1m x 9.1m) brick residence with 600 sq. ft.(55.5 sq.m) of floor space and a typical number of windows, may need 30-60 sq. ft.(2.75sq.m-5.5 sq. m) of louvered openings per floor. With each window measuring 3'x5'(.9m x 1.5 m) or 15 sq. ft. (1.3 sq.m), the equivalent of 2 to 4 windows per floor will need full window louvers.

Small pre-formed louvers set into a plywood panel or small slit-type registers at the base of inset panels generally cannot provide enough ventilation in most moist climates to offset condensation, but this approach is certainly better than no louvers at all. Louvers should be located to give cross ventilation, interior doors should be fixed ajar at least 4" (10cm) to allow air to circulate, and hatches to the attic should be left open.

Monitoring devices which can record internal temperature and humidity levels can be invaluable in determining if the internal climate is remaining stable. These units can be powered by portable battery packs or can be wired into electric service with data downloaded into laptop computers periodically. This can also give long-term information throughout the mothballing years. If it is determined that there are inadequate air exchanges to keep interior moisture levels under control, additional passive ventilation can be increased, or, if there is electric service, mechanical exhaust fans can be installed. One fan in a small to medium sized building can reduce the amount of louvering substantially.

If electric fans are used, study the environmental conditions of each property and determine if the fans should be controlled by thermostats or automatic timers. Humidistats, designed for enclosed climate control systems, generally are difficult to adapt for open mothballing conditions. How the system will draw in or exhaust air is also important. It may be determined that it is best to bring dry air in from the attic or upper

levels and force it out through lower basement windows. If the basement is damp, it may be best to zone it from the rest of the building and exhaust its air separately. Additionally, less humid day air is preferred over damper night air, and this can be controlled with a timer switch mounted to the fan.

The type of ventilation should not undermine the security of the building. The most secure installations use custom-made grills well anchored to the window frame, often set in plywood security panels. Some vents are formed using heavy millwork louvers set into existing window openings. For buildings where security is not a primary issue, where the interior is modest, and where there has been no heat for a long time, it may be possible to use lightweight galvanized metal grills in the window openings. A cost effective grill can be made from the expanded metal mesh lath used by plasterers and installed so that the mesh fins shed rainwater to the exterior.

Securing mechanical systems and utilities

At the outset, it is important to determine which utilities and services, such as electrical or telephone lines, are kept and which are cut off. As long as these services will not constitute a fire hazard, it is advisable to retain those which will help protect the property. Since the electrical needs will be limited in a vacant building, it is best to install a new temporary electric line and panel (100 amp) so that all the wiring is new and exposed. This will be much safer for the building, and allows easy access for reading the meter.

Most heating systems are shut down in long term mothballing. For furnaces fueled by oil, there are two choices for dealing with the tank. Either it must be filled to the top with oil to eliminate condensation or it should be drained. If it remains empty for more than a year, it will likely rust and not be reusable. Most tanks are drained if a newer type of system is envisioned when the building is put back into service. Gas systems with open flames should be turned off unless there is regular maintenance and frequent surveillance of the property. Gas lines are shut off by the utility company.

If a hot water radiator system is retained for low levels of heat, it generally must be modified to be a self-contained system and the water supply is capped at the meter. This recirculating system protects the property from extensive damage from burst pipes. Water is replaced with a water/glycol mix and the reserve tank must also be filled with this mixture. This keeps the modified system from freezing, if there is a power failure. If water service is cut off, pipes should be drained. Sewerage systems will require special care as sewer gas is explosive. Either the traps must be filled with glycol or the sewer line should be capped off at the building line.

Developing a maintenance and monitoring plan

While every effort may have been made to stabilize the property and to slow the deterioration of materials, natural disasters, storms, undetected leaks, and unwanted intrusion can still occur. A regular schedule for surveillance, maintenance, and monitoring should be established. The fire and police departments should be notified that the property will be vacant. A walk-through visit to familiarize these officials with the building's location, construction materials, and overall plan may be invaluable if they are called on in the future.

The optimum schedule for surveillance visits to the property will depend on the location of the property and the number of people who can assist with these activities. The more frequent the visits to check the property, the sooner that water leaks or break-ins will be

noticed. Also, the more frequently the building is entered, the better the air exchange. By keeping the site clear and the building in good repair, the community will know that the building has not been abandoned. The involvement of neighbors and community groups in caring for the property can ensure its protection from a variety of catastrophic circumstances.

The owner may utilize volunteers and service companies to undertake the work outlined in the maintenance chart. Service companies on a maintenance contract can provide yard, maintenance, and inspection services, and their reports or itemized bills reflecting work undertaken should be added to update the building file.

Sidebar

Mothballing Checklist

In reviewing mothballing plans, the following checklist may help to ensure that work items are not inadvertently omitted.

Moisture

- Is the roof watertight?
- Do the gutters retain their proper pitch and are they clean?
- Are downspout joints intact?
- Are drains unobstructed?
- Are windows and doors and their frames in good condition?
- Are masonry walls in good condition to seal out moisture?
- Is wood siding in good condition?
- Is site properly graded for water run-off?
- Is vegetation cleared from around the building foundation to avoid trapping moisture?

Pests

- Have nests/pests been removed from the building's interior and eaves?
- Are adequate screens in place to guard against pests?
- Has the building been inspected and treated for termites, carpenter ants, rodents, etc.?
- If toxic droppings from bats and pigeons are present, has a special company been brought in for its disposal?

Housekeeping

- Have the following been removed from the interior: trash, hazardous materials such as inflammable liquids, poisons, and paints and canned goods that could freeze and burst?
- Is the interior broom-clean?
- Have furnishings been removed to a safe location?
- If furnishings are remaining in the building, are they properly protected from dust, pests, ultraviolet light, and other potentially harmful problems?
- Have significant architectural elements that have become detached from the building been labeled and stored in a safe place?
- Is there a building file?

Security

- Have fire and police departments been notified that the building will be mothballed?
- Are smoke and fire detectors in working order?
- Are the exterior doors and windows securely fastened?
- Are plans in place to monitor the building on a regular basis?
- Are the keys to the building in a secure but accessible location?
- Are the grounds being kept from becoming overgrown?

Utilities

- Have utility companies disconnected/shut off or fully inspected water, gas, and electric lines?
- If the building will not remain heated, have water pipes been drained and glycol added?
- If the electricity is to be left on, is the wiring in safe condition?

Ventilation

- Have steps been taken to ensure proper ventilation of the building?
- Have interior doors been left open for ventilation purposes?
- Has the secured building been checked within the last 3 months for interior dampness or excessive humidity?

Maintenance Chart

1-3 months; periodic

- regular drive by surveillance
- check attic during storms if possible
- monthly walk arounds
- check entrances
- check window panes for breakage
- mowing as required
- check for graffiti or vandalism

- enter every 3 months to air out
- check for musty air
- check for moisture damage
- check battery packs and monitoring equipment
- check light bulbs
- check for evidence of pest intrusion

every 6 months; spring and fall

- site clean-up; pruning and trimming
- gutter and downspout check

- check crawlspace for pests
- clean out storm drains

every 12 months

- maintenance contract inspections for equipment/utilities
- check roof for loose or missing shingles
- termite and pest inspection/treatment
- exterior materials spot repair and touch up painting
- remove bird droppings or other stains from exterior
- check and update building file

Conclusion

Providing temporary protection and stabilization for vacant historic buildings can arrest deterioration and buy the owner valuable time to raise money for preservation or to find a compatible use for the property. A well planned mothballing project involves documenting the history and condition of the building, stabilizing the structure to slow down its deterioration, and finally, mothballing the structure to secure it. The three highest priorities for a mothballed building are 1) to protect the building from sudden loss, 2) to weatherize and maintain the property to stop moisture penetration, and 3) to control the humidity levels inside once the building has been secured.

While issues regarding mothballing may seem simple, the variables and intricacies of possible solutions make the decision-making process very important. Each building must be individually evaluated prior to mothballing. In addition, a variety of professional services as well as volunteer assistance is needed for careful planning and repair, sensitively designed protection measures, follow-up security surveillance, and cyclical maintenance.

In planning for the future of the building, complete and systematic records must be kept and generous funds allocated for mothballing. This will ensure that the historic property will be in stable condition for its eventual preservation, rehabilitation, or restoration.

Further Reading

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Acknowledgements

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Home page logo: Appropriately mothballed historic building. Photo: NPS files.

This publication has been prepared pursuant to the National Historic Preservation Act of 1966, as amended, which directs the Secretary of the Interior to develop and make available information concerning historic properties. Technical Preservation Services (TPS), Heritage Preservation Services Division, National Park Service prepares standards, guidelines, and other educational materials on responsible historic preservation treatments to a broad public.

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